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Contents

NOTICES:—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Communications relating to advertisements or general matters should be addressed to the Manager.

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1923-1924

A CAREFUL study of the reports, written by a group of first rate authorities and published in this issue, on the general condition of British chemical industry, is on the whole reassuring. If prosperity still lingers and trade goes forward rather haltingly, the essential point is that it is going forward. It is not stagnant; still less is it retreating. Such movement as is taking place is progressive, and the only matter for regret is that there is not more of it. As more than one writer truly points out, the chemical industry is dependent for its success on the success of the whole body of British industry, which it permeates through all its parts. Many of its products, it is true, reach the public in a direct form, but a still larger proportion are absorbed by other industries in the manufacture of public commodities. In these circumstances it is obvious that when national trade is slack the demand for chemical products must slacken in proportion. What is wanted, therefore, is a recovery of national prosperity, in which all branches of chemical industry must necessarily share. And that must come of itself in the usual way. The hope, whether well or ill-founded, of which so much was heard in the recent election, of rapidly restoring trade by amendment of our fisca system, has disappeared. No departure from our traditional Free Trade policy and no capital levy imposition is possible for a long time to come; to that extent the situation has been stabilised by the general election, and the nation must depend on what has ever been its principal asset—its own unrivalled capacity for business.

Looking over the developments of the year that is now closing, 1923 promises to be remembered as a period of good average progress rather than one of exceptional achievement. Whether we take the dyestuffs industry, heavy chemicals or fine chemicals, the progress of invention and research, the study of chemical engineering problems, or the general organisation of chemical and allied societies, we shall find abundant evidence of sound progress in every section, without, however, any single results big enough in themselves to make the year historic. In so essentially scientific an industry as chemistry the key to progress must always be found in research. It is safe to say that at no time in our industry has there been such a body of research work as that in progress to-day, the results of which, it must be remembered, may appear months or even years hence.

Dr. E. B. Maxted once more reviews in his clear and comprehensive way the developments in the study of nitrogen fixation problems in this and other countries. In this field we doubt if it is possible at the moment to obtain the latest information as to what is being done in this country. When the information is disclosed we believe it will show satisfactory progress. In connection with the subject of synthetic ammonia, it may be well to read what so good an authority as Dr. Sidney Williamson has to say on the chemical fertiliser industry. From the detailed review, again, of chemical invention in 1923, by our Patent Correspondent, some impression may be gained of the immense volume of intensive research into all sorts of problems which is daily going on and the steady improvement in detail which is thus being effected. Attention is drawn to important advances in colloidal chemistry. The principles and results of the Plauson Colloid Mill were first described authoritatively in this journal, and with this may be mentioned two other developments which are now attracting great interest—the Stream-Line Filter, the invention of a British engineer, and Silica Gel, respecting which some very high claims are confidently made.

The position of Great Britain in the field of heavy chemicals has long been predominant, and it is clear from the article by Mr. P. Parrish that the position is well maintained and that the industry keeps pace with the latest developments. This position is largely the result of the work of two great concerns—the United

Alkali Co., which celebrated its centenary this year, and Brunner, Mond and Co., which a little later celebrated its jubilee. In the matter of fine chemicals, 1923 and the years preceding it have been periods of great interest and some anxiety. It is clear that, in spite of many difficulties, the British fine chemical industry, as regards scientific equipment and productive capacity, is in an appreciably stronger position than ever before as the results of the efforts of the leading firms in the past few years. It is unthinkable that the progress already made should be sacrificed; what is wanted is steady perseverance in the policy which has brought about these good results, and the fullest measure of support and encouragement that the industry and the nation can give.

The dyestuffs industry, even more than the fine chemical industry, owes its existence in its present form to the drastic lessons the nation learned during the war, and which there is a tendency in some quarters too readily to forget. Those with eyes—or powerful magnifying lenses—for every sort of defect, error and deficiency in detail may no doubt find much to satisfy their critical faculties, but those who have any vision for the truly great results which have been achieved within so short a space will see in them the amplest vindication of British organising and productive capacity. We have before remarked that the greatest testimony to what has been accomplished is the fact that the whole controversy has been narrowed down to the question of price. The quality of British dyestuffs is now established. The range, already large, is steadily being extended. We have probably to-day the best school of dyestuff research in the world. The price problem is due to two difficulties—the preposterous condition of foreign exchange and the slack state of the textile and other colour-using industries. Cheap production is dependent on large output, and when trade revives it should be possible, by more economical quantity production, to effect still further reductions in selling prices. The sound and balanced survey of the dyestuffs industry which Sir William Alexander, M.P., contributes to this issue may be commended to all interested in the subject. To him the country owes a debt for the courage with which he accepted a task of unusual difficulty and for the success with which he and his colleagues are gradually placing the industry on a sound economic and scientific basis.

The course of chemical business from the merchanting point of view is reviewed with his usual thoroughness and knowledge by "W. G. W.," and the conclusions as a whole are distinctly favourable. Our correspondent's confident opinion is that the outlook for export trade is distinctly bright, and that with an improvement in the textile and other chemical-consuming industries there would be little to worry about. Although financial conditions have been difficult, the number of failures have been small, and have been mainly confined to unimportant concerns.

There are still other matters on which progress may briefly be noted. Something has been done during the year to put the study of chemical engineering on a more definite basis, and to define the kind of training suitable for this new dual profession, while the periodical conferences for the exchange of experience and opinions among chemists in charge of or otherwise interested in works plant are increasing rather than declining in interest. The process of standardisation in many directions is also making sure, if somewhat slow, progress. Beyond all this, it is satisfactory to note the increased attention given to chemical organisation in general, and the tendency of uniting influences to override sectional jealousies which have too long been permitted to obstruct progress. Taken as a whole, the signs all round are good, and in taking leave of 1923, with its many contributions to progress, one may confidently predict an equal, if not better, record in 1924.

Selective Adsorption

THE question of the relative merits of adsorptive mediums has come in for a good share of attention lately, and when, as in this case, one finds two definite schools of thought in evidence it is not without profit that one follows the arguments raised by both sides. Both activated carbon and silica gel have their protagonists, and there can be no doubt that the entry of the newer material into the field has spurred on the carbon school to renewed effort which must all eventuate to the benefit of those industries in which this material plays so important a *rôle*. At a recent meeting of the American Institute of Chemical Engineers, Mr. N. K. Chaney, who with a couple of collaborators has been studying the properties of activated carbon, and who will be remembered in connection with the Chaney processes of carbon activation, raised an important point which should not be neglected when determining the relative efficiency of adsorbents. The matter really comes down to one of preferential or selective adsorption, and Mr. Chaney contends that active carbon and silica gel are diametrically opposed with respect to their relative adsorption of water and hydrocarbon derivatives. For instance, if the retentivity of carbon were defined by its power of retaining water vapour instead of, say, toluene, the retentivity would be zero. In a stream of dry air carbon gives up its water at room temperatures. Applying the same criteria to silica gel, its specific adsorptive power, while much less marked than that of carbon, is definitely selective for water. In fact, all the water cannot be expelled from the gel without breaking down the physical structure of the granules, and this makes the selection of a basis for defining the water retentivity a little difficult.

That this selectivity of adsorption is a very practical reality is readily demonstrated by the simple experiment of shaking up a mixture of water and benzene with activated carbon and silica gel respectively. The carbon will adsorb the benzene, and if enough benzene is present to saturate the carbon the water will be completely rejected. The silica gel will take up water and reject benzene. These facts seem, according to the American workers, to prove beyond question that any theory of adsorption which disregards the chemical nature of the adsorbent and the adsorbed substances is incomplete from a theoretical point of view and inadequate from a practical standpoint. As a matter of fact, even a capillary theory of adsorption must recognise the predetermining influence of specific chemical factors, inasmuch as capillary phenomena may exhibit certain sharply contrasting aspects depending upon whether the capillaries are wetted by the liquid or not. Mr. Chaney and his co-workers sum

up their contentions in no unhesitating manner, for they say that it is the selective adsorption of water which destroys, for certain purposes, the value of silica gel, ferric oxide gel, and similar adsorbents; and it is the lack of the same property which makes carbon of unique and irreplaceable value. We have no doubt that the silica gel adherents have a satisfactory rejoinder which those of our readers who are following up this interesting matter would be glad to hear.

Germany and Synthetic Oils

QUITE a number of our readers who were interested in what we had to say in these columns a few weeks ago in connection with recent studies relating to the synthesis of methane from hydrogen and carbon monoxide will find additional interest in the proposals which emanate from the Kaiser Wilhelm Institute at Mülheim. Two workers at this Institute, Fischer and Tropsch, the former well known in connection with suggestions for the hydrogenation of coal, have lately published a long account of a process for producing a synthetic oil mixture from carbon monoxide and hydrogen. It is important to note that the production of oils from coal can take place in two ways, namely, by hydrogenation, or by gasifying the coal in the first instance and then treating the gas so as to obtain a substitute for petroleum. The novel process is, of course, this latter one. The process takes place in three stages: first, the distillation of the coal on low-temperature principles, and the utilisation in the ordinary manner of the straight gas so produced; second, the conversion of the low-temperature coke into water gas; and, third, the production catalytically of oils from the water gas. Briefly, the third stage consists in purifying the crude water gas from sulphur compounds, after which it is subjected to a pressure of about 2,000 lb. per square inch and a temperature of some 400° C. in the presence of a suitable contact agent, the last-named being either iron filings or shavings coated with potassium carbonate. Under such treatment the original gas mixture, when passed through a condenser, forms a liquid product which separates into a watery solution and an oily layer, in the proportion, approximately, of two of the former to one of the latter. The watery solution has been shown to consist of such compounds as acetic and formic acids and certain alcohols and acetone, while the oily material is composed of the higher alcohols from which a valuable motor fuel can be produced. Apart from its importance to a nation such as Germany, which as regards oil supplies is placed very much as ourselves, the process is interesting by reason of the fact that some years ago the Badische concern attempted experiments on similar lines and abandoned the researches owing to the unsatisfactory character of the products obtained, but Fischer seems, by working on rather different lines, to have succeeded in modifying the products with considerably more hope of commercial success.

"C.A." Metallurgical Section

NEXT week, as already announced, there will appear in THE CHEMICAL AGE the first number of our Metallurgical Section. This is an experiment designed to meet the needs of readers who desire to be kept in touch with metallurgical developments, and to provide an opportunity for the metallurgist himself to deal with the latest phases of his own problems. This addition to the regular features of the paper will, it is hoped, increase its value to the regular chemical reader and at the same time give metallurgists some useful information as to the most recent chemical developments. The Metallurgical Section will appear in the first issue of THE CHEMICAL AGE each month. The first issue of January 5 will contain an article by Mr. Fred Clements on "Probable Developments in the Manufacture of Iron and Steel," notes by a metallurgical expert on the principal events of the month, an article on market and general conditions in the industry, a review of the principal metallurgical patents, an index to the metallurgical literature of the month, and a summary of official commercial information.

Books Received

THE CHEMIST AND DRUGGIST DIARY, 1924. London: *The Chemist and Druggist*. Pp. 430.

THE UTILISATION OF LOW-GRADE AND WASTE FUEL. By W. F. Goodrich. London: Ernest Benn, Ltd. Pp. 368. 42s.

DIE GALVANISCHEN METALLMEDERSCHLAGE UND DEREN AUSFUHRUNG. By Hubert Steinach und Georg Buchner. Berlin: M. Krayn. Pp. 188. 6s.

THE THERMAL PROPERTIES OF ETHYL CHLORIDE. By C. F. Jenkin and D. N. Shorthose. Food Investigation Board Special Report No. 14. London: H.M. Stationery Office. Pp. 34. 1s. 6d.

The Calendar

Dec. 29 to Jan. 9	Scientific Novelties Exhibition: Demonstrations and Experiments. 2-5 p.m. and 6-9 p.m.	King's College, Strand, London.
Jan. 2 and 3	Physical Society of London and the Optical Society: Annual Exhibition of Electrical, Optical and other Physical Apparatus. 3-6 p.m. and 7-10 p.m.	Imperial College of Science and Technology, South Kensington.
3	Society of Chemical Industry (Bristol Section): "The Chemical Technology of Canned Foods." O. Jones. 7.30 p.m.	The University, Bristol.
7	Society of Chemical Industry (London Section): Ordinary Meeting. 8 p.m.	Burlington House, Piccadilly, W.1
7	Institution of Rubber Industry (London Section): "Consistency of Rubber and Rubber Compounds." Dr. S. S. Pickles. 8 p.m.	Engineers' Club, Coventry Street, London, W.
8	Institute of Metals (North-East Coast Section): "The Action of Molten Brass on Nickel-Steel." H. M. Duncan. 7.30 p.m.	Armstrong College, Newcastle-on-Tyne.
8	Institute of Metals (Birmingham Section): "Nickel Brasses." O. Smalley. 7 p.m.	Chamber of Commerce, New Street, Birmingham.
8	Hull Chemical and Engineering Society: "X-Rays and Their Application." J. Pryce Jones. 7.45 p.m.	Hull Photographic Society's Rooms, Park Street, Hull.
10	Institute of Metals (London Section): "X-Rays and Metallurgy." W. T. Griffiths. 8 p.m.	85-88, Minories, Tower Hill, London.
11	Institute of Metals (Sheffield Section): Conjoint Meeting with the Institute of British Foundrymen. "Influence of Casting Temperature on the Physical Properties of Metals." F. H. Hurren. 7.45 p.m.	Albany Hotel, Fargate.

1923: A Retrospect

Developments in Chemical Industry, Commerce, and Organisation

THE utter collapse of the German paper mark in currency value was one of the most noteworthy events of the year so far as international trade is concerned. For several years British trade has been hampered by the low and fluctuating value of the mark, but when the exchange value dropped to the fantastic figure of many milliards to the pound sterling the paper mark could no longer be regarded seriously as of any value for international trading purposes. The occupation of the Ruhr by the French and the seizure of large stocks of German dyestuffs by the French and Belgians also had a disturbing influence upon international trade. For a long period the low value of the mark enabled Germany to place her goods in foreign markets at prices with which British merchants could not compete, but for some time past the costs of German production have been rising, and a circular recently issued by the German Potash Syndicate gives some indication of the changing position. It says that the repeated demands of the workers for gold wages which should be gradually adjusted to pre-war rates would, in the opinion of the Syndicate, lead, in connection with the pending reform of the currency, to a still further increase in the costs of production and thereby to new price advances the extent of which could not be foreseen.

All recent reports agree in the statement that industrial difficulties are increasing in Germany, and that in future German goods cannot be sold in foreign markets at the low prices recently prevailing. Taken as a whole, the past year has been moderately good for British chemical industries, although at times business has been rather dull. When the figures for the whole year are available it will probably be found that when compared with the preceding year both the imports and the exports have increased. Also that the increase in the amount of the chemical exports, which are more important to the nation than the imports, is as large as could reasonably be hoped for under the abnormal conditions under which our trade has been conducted.

The Chemical Societies

Some progress has been made during the year with the task of drawing together the members of the chief chemical associations. A Bureau consisting of representatives of the Chemical Society and the Society of Chemical Industry has been formed for the purpose of issuing in a single publication the abstracts of papers relating to both pure and applied chemistry, which have hitherto been published separately by the two Societies. It is expected that improvements and economies will result from this co-operation. The Chemical Society, the Institute of Chemistry, and the Society of Chemical Industry worked together in arranging a dinner of chemists, which was held in London in October last. This friendly meeting of the members of the three associations should tend to make easier the task of forming a Council which will operate for the benefit of all descriptions of chemists and possess greater political influence than that of any one of the separate associations. The Federal Council for Pure and Applied Chemistry is continuing its endeavours to provide a suitable meeting house for all interested in the study or practice of chemistry and adequate accommodation for a comprehensive chemical library.

The B.A.C. continues its activities and has been doing good work in assisting chemists through its Legal Aid and Unemployment Funds. The last annual report showed that the B.A.C. has suffered some decrease in membership, but this is believed to be mainly due to the depression in the chemical industries and partly to the withdrawal of those members who were opposed on principle to the inauguration of the Unemployment Benefit Fund. The Society of Public Analysts, through its Council, has been urging upon the Ministry of Health the necessity of increasing the fees paid to public analysts in view of the difficult work now entailed, especially in connection with analyses of dispensed medicines. It is pointed out that an unjustifiable burden is being put upon the analyst in calling upon him to analyse complex mixtures of medicinal compounds for the small fee usually paid.

The Association of British Chemical Manufacturers has been actively engaged with various matters affecting chemical industries, such as standard railway rates, smoke abatement legislation, the Safeguarding of Industries Act, and publicity measures. The General Manager has been authorised to have two films prepared, one illustrative of the coal tar distillation industry and the other of the heavy chemical industry.

The Chemical Industry Club has continued to grow but still desires to enrol more members. The Club is a pleasant meeting place for all associated with chemical industry or the study of chemistry. The Club has recently decided to have a President and a Vice-President, and has elected Sir William Pope to be first President and Dr. Hodgkinson to be first Vice-President.

A very successful meeting of the International Union of Pure and Applied Chemistry was held in June at Cambridge. It was attended by many distinguished chemists from abroad. The next annual meeting is to be held at Copenhagen.

Exhibition Preparations

The Chemical Section of the British Empire Exhibition, 1924, to be held at Wembley, is being organised by the Association of British Chemical Manufacturers, and the arrangements have been progressing satisfactorily during the past few months. The Scientific Section is being organised by a Committee consisting of representatives of the Chemical Society, the Society of Chemical Industry, the Institute of Chemistry, the Society of Dyers and Colourists, the Pharmaceutical Society, the Institution of Petroleum Technologists, and the Institution of Chemical Engineers. This Committee is working in co-operation with the Royal Society, and the Scientific Section promises to be the most interesting exhibition of the kind ever held.

Japanese Calamity

On Saturday, September 1, a great earthquake in Japan caused the collapse of many buildings in Yokohama and Tokio, and fires speedily broke out in many parts of the towns. Yokohama was almost completely destroyed and a considerable portion of Tokio was burnt out. Many thousands of lives were lost and immense quantities of goods were burnt. Relief ships carrying food and other supplies were hurried to Japan by British and Americans as soon as news of the disaster was received, and large sums of money were raised in different parts of the world to help the Japanese authorities to provide for the survivors and reconstruct their chief port and capital city. It is reported that rebuilding and the re-establishment of businesses has been carried on very rapidly and that great progress has been made towards a return to normal conditions, but many Japanese chemical industries must have received a severe check, and the prices of many of her exported goods have naturally increased for a time.

The Japanese Patent Office was one of the buildings destroyed by fire in Tokio. It is stated that all the documents, including the original patent registers, have been lost, and all owners of patents and trade marks should apply for re-registration under the Japanese Emergency Ordinance.

The Government Laboratory

The report of the Government chemist upon the work carried out in the Government laboratory during the year ending March 31, 1923, contained, as usual, much interesting information concerning the composition of food and drugs. Items of general interest in the report are the facts that as the result of work carried out for the Office of Works it has been found that an excellent preservative for the old tiles in the Chapter House, Westminster, has been found in the use of aqueous 3 per cent. casein containing a little formaldehyde followed by a thin coat of matt varnish, and that analyses made for the Department of Scientific and Industrial Research have shown the presence of helium in natural gas from bore-holes in this country in quantities varying from 0.005 to about 0·2 per cent. by volume.

British Celanese, Ltd.

The producers of artficial silk formerly known as the British Cellulose and Chemical Manufacturing Co., have changed the name of the company to British Celanese, Ltd. The manufacturing departments have been extended to enable from 4½ to 8 tons of yarn to be produced per day according

to the varieties of yarn required. At the annual meeting of the company, the Chairman, Sir Harry McGowan, pointed out that celanese is an excellent insulator for electricity, heat and cold, and that so much progress has been made with regard to dyeing the material that the technical advisers of the company now believe that they can produce celanese dyed to any colour or degree of fastness that may be required.

Contamination of Chemicals

In April last a firm of chemists was summoned by the Birmingham Corporation for the sale of potassium carbonate containing arsenic and lead in quantities exceeding the limits incorporated in the B.P. The evidence for the defence showed that the contamination with excessive quantities of arsenic and lead was due to the action of the apparently dry potassium carbonate on the glass bottle in which it was stored, and the case was dismissed. Further examination showed that where the storage bottles were made of soda glass instead of lead glass the potassium carbonate did not contain excessive quantities of lead or arsenic. As a result of this discovery a very large number of bottles have been withdrawn from the shops and replaced by bottles free from lead and arsenic.

Dyestuffs

The French occupation of the Ruhr and the bemuddled financial and political conditions prevailing throughout the German Empire greatly disturbed the German dye industry, and German dye production decreased during the year.

The British dye industry, on the other hand, has become more firmly established. British dyes have gained a good reputation abroad, and the quantities of dyes exported from Great Britain during the year greatly exceeded the quantities exported in the preceding year. During the year Professor A. G. Green, Director of Research and Chief Chemist to the British Dyestuffs' Corporation, resigned his position and was succeeded by Professor W. H. Perkin. Professor Perkin had already had some association with the Corporation, as he had for some time been controller of the research work carried out at Oxford for the Corporation. Dr. Herbert Levinstein resigned from the Dyestuffs Industry Development Committee, and the Board of Trade appointed Dr. A. T. de Mouilpied to take his place.

The Stream-line Filter

A lively interest has been aroused in chemical circles in the subject of filtration by the stream-line filter recently devised by Dr. Hele-Shaw. A paper on the stream-line filter was read by Dr. Hele-Shaw in June before the London Section of the Society of Chemical Industry. The filter consists of one or more packs of impervious material, preferably paper made waterproof and oilproof. The pack is held between two ends called press heads. The pressure can be controlled to meet the requirements of the liquid to be filtered. To get edge filtration each sheet is perforated with an identical number of holes in such a way that the holes lie in alternate rows of large and small holes. When the sheets, to the number of 4,000 or 5,000, are put together in a pack the holes form tubes. Into one row of tubes the liquid to be filtered is forced under pressure from the press head and the opposite ends of the tubes remain closed. There is no escape for the liquid except through the interstices of the sheets. The area of filtration is represented by the area of the inner surface of the larger cylindrical tubes. The smaller tubes are sufficient for the discharge of the filtrate. Dyestuffs are removed from solution or suspension by passage through the filter. Milk is discharged as a clear filtrate, almost tasteless. Sugar solutions are decolourised. When a mixture of clean oil and water is passed into the filter both the oil and the water pass through, but they immediately separate. The secret of the filter is, says Dr. Hele-Shaw, the roughness of the surface. Calendered paper is too smooth and will not effect filtration. The invention appears to be of much industrial importance, and further information concerning it may be obtained by reference to the illustrated description published in THE CHEMICAL AGE of September 29 last.

Italian Potash

Hitherto the world has been dependent upon the German Stassfurt deposits for the supply of most of the potash it has required, the proportion obtained from Alsace and all other sources being comparatively small. In a paper read last month on "A New Source of Potash and its Industrial Exploitation," before the Chemical Engineering Group of the Society of Chemical Industry, Professor Hinchley indicated that the potash which is present in leucite, a mineral which exists in immense quantities in Italy, may soon become a formidable competitor against German potash.

During the war, when the supply of potassium salts available for the use of the Allies was very limited, Baron Blanc tested several samples of Italian lavas with a view to the extraction of potash, and he discovered an abundant supply of leucite. As a result the Societa Italiana Potassa has been formed, and an Italian potash industry now exists. Pure leucite contains 21·5 per cent. potash, 23·5 per cent. alumina, and 55 per cent. silica.

The deposits are found near the craters of extinct volcanoes and close to the earth's surface. The quantity of leucite discovered is sufficient to supply the world at the present rate of potash consumption for many centuries. The deposit now being worked lies about 30 miles north of Naples and about 12 miles from the seaport of Scauri.

The mineral is first crushed and then subjected to electro-magnetic treatment to remove the gangue. It is then ready for use as a fertiliser, or it can readily be converted into potash alum by the action of sulphuric acid. By reaction with hydrochloric acid the potash and alumina can be converted into the chlorides of potassium and aluminium and from the residual silica sodium silicate can be produced by simple treatment with caustic soda.

Petroleum

In spite of the ever-increasing consumption of petrol and fuel oil the increase in the quantity of crude petroleum taken from wells in the United States has been more than sufficient to meet the increased demands. There has been much over-production, especially in California. During the year prices of crude oil, and of the distillates therefrom, have dropped, and a large number of refineries in various parts of the United States have been compelled to close because of their inability to compete with the cheap Californian petrol. Early in the present month, however, it was reported that during October the stocks of petrol in the United States had substantially decreased and that the demand now exceeds the supply. It is probable, therefore, that some of the closed refineries will soon be at work again.

The improvements that have been made in drilling machinery in recent years have made possible the drilling of deeper wells, and in South California oil is now being obtained from a depth of 6,000 ft. The deepest borehole in California, which has been put down by the Standard Oil Co., has reached a depth of over 7,200 ft.

Little has been heard about the search for petroleum in Great Britain since the Government abandoned the search and announced, early in the year, that it had disposed of the D'Arcy bore-hole to a Scottish syndicate and the Hardstoft bore-hole to the Duke of Devonshire. The attempts to work the Norfolk shales have not yet been commercially successful, and do not appear to have much prospect of success while the market prices of petroleum distillates remain at their present low figures.

Efforts continue to be made to utilise petroleum distillates heavier than petrol for motor vehicles. Kerosene has long been used, but recently a mixture of gas oil with petrol and ether has been introduced under the name "Pynol." It has been found that pynol can be used quite successfully in all kinds of vehicles employed for the transport of passengers or goods, and the mixture is already being manufactured in several towns in Germany. Arrangements have been made for its production on a large scale in England, and a site has been acquired at Port Victoria, where the Medway joins the Thames.

Rubber

Owing to the restriction of the output of rubber arranged between rubber growers of the Malay Peninsula the price of rubber has been maintained at between 14d. and 15d. per lb. for a large part of the year, and a large number of rubber-producing companies have made a satisfactory profit under this arrangement. Some growers are still, however, handicapped by loans or debentures obtained during the recent years when cost of production was greater than the selling price of rubber, and have had to use nearly all their modest profits in reducing loans or paying interest on debentures secured under onerous conditions.

Rubber latex now appears in the exports from British Malaya, and is mostly sent to Great Britain and America. The latex is being extensively used in paper manufacture. China Clay coated with rubber can be prepared by mixing alkaline latex with China Clay suspended in water and then adding any suitable precipitant. The particles of clay become coated with rubber, and fall to the bottom of the containing vessel. It can then be collected, dried and used for waterproofing. A letter relating to this subject from Mr. G. C. Calvert was published in our issue of July 21 last, and an article on "Rubber Latex Precipitates and Dispersion" appeared in our issue dated March 31.

Home Grown Sugar

The effort to establish the cultivation of beets and the manufacture of sugar therefrom as an important English industry continues. At the seventh annual general meeting of the English Beet Sugar Corporation, held in London in October, it was reported that the net profit for the year was £103,981. Less technical assistance is now required than formerly. The chairman pointed out that in the early days of working the Corporation's factory at Cantley two hundred foreign operatives were brought over for each campaign, whereas now only ten are needed. Beets containing over 18 per cent. of sugar are obtained in the Eastern counties. The proposal to amalgamate the Corporation with Home Grown Sugar, Ltd., the owners of the sugar factory at Kelham, is still under consideration.

An attempt to establish a beet sugar factory at Kidderminster is also being made. The local farmers have consented to provide the necessary acreage of beets, and Kidderminster Corporation has offered suitable land on the Worcester Road.

If the Government will continue to abstain from claiming duty on home-grown sugar it is quite possible that beet cultivation for sugar production may become a profitable English industry and give employment to a large number of men and women. Credit is due to the pioneer workers for their long-sustained efforts.

Sulphate of Ammonia

At the annual meeting of the British Sulphate of Ammonia Federation, Ltd., held in London last month, the chairman, Mr. Milne Watson, gave some interesting particulars concerning the production of ammonium sulphate. The British production for last year was, he said, about 50 per cent. larger than for 1921–22. The total exports show a gain of about 58 per cent., and home deliveries an increase of 3 per cent. on the previous year. The sulphate of ammonia industry is still suffering from high costs of production and, in particular, from the high cost of sulphuric acid. Before the war sulphuric acid could be bought for 25s. per ton, whereas the lowest price at which the acid is now being sold, so far as Mr. Watson is aware, is 55s. per ton. During the last decade there has been an increase of 53 per cent. in the world's consumption of sulphate of ammonia.

Last year Synthetic Ammonia and Nitrates, Ltd., joined the Federation, and they are now producers of sulphate. This year it was announced that Canadian producers of sulphate of ammonia representing a large proportion of the total output of that country had joined the Federation.

The market price of sulphate of ammonia has been falling for some time, and Mr. Milne Watson, when giving evidence before the Director of Gas Administration last month, said that the Germans had come into the export market with quite large quantities, and that prices had broken all over the world.

The Federation annual report says that while no large increase in the recovery of ammonia from by-product ovens and coal-gas seems likely in the near future, a considerable addition to the world's supply may be expected from synthetic plants both in England and in other countries, and the time is therefore probably approaching when the output of ammonia compounds will be at least equal to, if not greater than, the production of nitrate of soda.

The new projects include a Haber plant at Toulouse to make 180,000 tons of sulphate of ammonia per annum, and it is hoped to add 50,000 tons per annum to the supply available in Northern France by working the Claude process at coke oven plants.

Silica Gel

Much attention has recently been given to silica gel and other inorganic gels. Silica gel can be used as an adsorbent for benzol in coke oven gas, for refining petroleum oils, for the adsorption of oxides of nitrogen or for dehydrating air. It is too early yet to give any useful statement as to its industrial value in competition with other adsorbents or absorbents, but the American Silica Gel Corporation has entered into contracts both in England and America for the application of silica gel processes for certain industrial purposes. It is intended to form an English Silica Gel Company to co-operate with the American Corporation. As an absorbent of water vapour it has been found that silica gel can be usefully applied in refrigerating plants. In the coming year silica gel plants will be put to practical tests in many ways, and the results will be awaited with interest.

Broadcasting

On account of its novelty mention must be made of the fact that this year the practice has been introduced of broadcasting scientific discourses to the multitude of owners of wireless receiving sets in Great Britain. Notable instances were the broadcasting from Liverpool of Sir Ernest Rutherford's presidential address to the British Association, and the broadcasting from London of a short address by Mr. Woolcock on "Applied Chemistry in Modern Life."

Safeguarding Act

The working of the Safeguarding of Industries Act continued to be a subject of much discussion throughout the year. The Referee, after hearing complaints, decided that formaldehyde should be excluded from the list of articles liable to duty, but that Rochelle salt must remain in the list.

Late in October a circular was issued to members of the British Chemical and Dyestuff Traders' Association advising them that the Customs intend to ignore the value of goods stated on an importer's invoice where they consider the stated value to be below the fair market price, although they accept such invoice as being perfectly genuine and as specifying the actual purchase price, and to assess goods at what in their opinion represents the fair market price in this country on the date the goods are landed. The Association protested and submitted that the Customs would be exceeding the powers given to them if they demanded duty on any value other than that shown on a genuine invoice. Obviously it will be difficult for traders to do business if they have no means of knowing what the amount of duty to be paid on goods imported will be.

Gifts

It is pleasant to be able to record that during the year valuable gifts have continued to be given to scientific training and research institutions. Sir Alfred Yarrow has given £100,000 to the Royal Society to be used in promoting scientific research. Mr. Hood has given the University of Edinburgh £15,000 for a chair of Mining. £12,000 has been given anonymously to Armstrong College, Newcastle, to provide more facilities for research. Mrs. Ludwig Mond bequeathed £2,000 to the University of Manchester for Ludwig Mond lectures, £300 to the University of Liverpool and £1,000 to Bedford College, London. Colonel Sir Edward Brotherton gave £500 towards the equipment of a new bacteriological department for the Royal Bath Hospital at Harrogate. Mr. James Smith bequeathed £1,000 to Glasgow Royal Technical College. The General Electric Co. of New York gave $3,000, and the British Thomson-Houston Co. gave £250, for promoting research at the Cavendish Laboratory, Cambridge. Brunner, Mond and Co. gave £150 for assistance of research in the metallurgical department of Manchester University. The Gas Light and Coke Co. of London agreed to provide funds for a post-graduate Research Fellowship in connection with the department of Chemical Technology in the Imperial College of Science and Technology. The Clothworkers' Company of the City of London has offered to contribute £5,000 per annum for five years for the development of the City and Guilds (Engineering) College.

The list of gifts presented during the year might be continued, but is already long enough to show that the need for continued research work is now generally recognised.

Obituary

Amongst the chemists who have passed away during the year the following were well known in the chemical world:—A. Carey, Sir James Dewar, W. J. Leonard, F. J. Lloyd, G. Lunge, H. M. McLeod, E. W. Morley, Edmund K. Muspratt. Sydney K. Muspratt, M. P. C. Potvliet, S. P. Sharples, J. E. Stead, W. Thomson, J. D. Van de Waals, F. E. Weston, J. M. Wilkie and Dr. J. A. Harker. H. F. H.

The Dyestuffs Industry in 1923

By Brig.-General Sir William Alexander, K.B.E., C.B., C.M.G., D.S.O., M.P.

(Chairman of the British Dyestuffs Corporation, Ltd.)

THE general depression in the trade of this country to which we are now almost becoming accustomed has, of course, during 1923 continued still to affect the Dyestuffs Industry, which, inasmuch as it produces no product used directly by the ultimate consumer, must remain to a great extent dependent on the prosperity of other industries. A revival in iron and steel manufactures is said by leading economists to be the best early indication of a trade revival; the state of the dyestuffs industry must also, by the nature of things, be an accurate reflection of the state of business in general.

The home market, although it exhibited during the year encouraging signs of a distinct revival that at the time roused our hopes, but which in retrospect now appear to have been little more than the normal and seasonal ebb and flow characteristic of the trade whatever its volume, has been somewhat livelier than during the year 1922. In some groups of colours there has been a decided improvement. The railway companies, now that the fusions have been completed, appear to be spending more freely on the necessary repairs and maintenance work, and the demand for paint, enamels, etc., stimulates business in the special group of colours which are used for this purpose. Despite the prophets, improvement in the cotton trade is as yet slow, and so long as raw cotton remains at its present price probably little hope can be entertained of the trade reaching its normal dimensions. The state of the cotton trade is a powerful indication of the trade of the Dyestuffs Industry, and normal conditions are not to be expected until this great staple trade is once more in a healthy and flourishing condition.

Increase in Exports

It is pleasing, however, to be able to chronicle during the year an increase in the exports. The official figures issued by the Board of Trade show that there has been a steady monthly improvement in the export figures for dyestuffs, and that the total for the ten months to October is practically double the corresponding figures for last year.

As yet, however, we cannot regard these exports as a normal condition for this country, since the reason for their being so much greater than in 1922 is due to the political situation in Germany, which interfered with the steady flow of dyestuffs from that country, and to the deficit being made good from British sources of supply. It may be taken, however, as satisfactory evidence that the uniformly high quality of British dyestuffs is becoming increasingly well known in foreign markets, and as a good reputation is an early preliminary for the establishment of a permanent export trade, it is a step in the right direction. In this connection it is, perhaps, worth mentioning that the greatest asset the German manufacturers have to-day is not so much the quality of their products as their ability, due to the chaotic state of the mark, to quote low prices. As the year closes there are indications which, if maintained, will result in some steady improvement during the coming year. After all, a consistent improvement in trade is what this country chiefly needs—one that comes from the gradual healing of the gashing wounds inflicted on the commerce of Europe during the Great War.

During the year the relations between the Chemical Employers' Federation and the workpeople have continued to be highly satisfactory. The Joint Industrial Council has again rendered valuable assistance in the solution of the difficulties which have arisen from time to time. The German Dyestuffs firms were pioneers in welfare work, and the British Dyestuffs Industry has not been slow in taking up and developing this essential feature in the good relationship which should exist between employer and employee. The majority of dyestuffs concerns in this country have attached to their works various sports and social organisations.

Quality and Range of Dyestuffs

For some two years now the British manufacturers have devoted earnest and detailed attention towards steadily improving the quality of their dyes, and the standard of the production of the year has been distinctly raised. The statement earlier in the year on this point by Mr. Sutcliffe Smith, the Chairman of the Colour Users' Association, has placed this beyond contention. I do not think it would be disputed to-day that the general level of quality of British makers' production is equal to that of the best Continental manufacturers.

During the year under review great attention has continued to be given by manufacturers to the all-important matter of extending the range and number of British-made dyestuffs; and whilst satisfactory progres is still being made in this direction, the important gaps are now rapidly becoming few and far between. It is, perhaps, not sufficiently realised what splendid efforts have been made towards this end. The placing on the market during a year of about a score of dyestuffs not hitherto made in this country is at the least a great piece of organisation. All departments of the industry have to play their part: it means research, the design and erection of plant, manufacture of intermediates, detailed and careful investigation in the dyehouse, the preparation of technical literature and pattern cards.

Of necessity in the past years effort has been chiefly and wisely directed by the makers towards this object, and it is highly satisfactory to observe in the year under review the appearance of brand-new British colours—viz., the Caledon Jade-green colours of the Scottish Dyes, Limited, a series of Vat dyestuffs and the Cellutyl series of the British Dyestuffs Corporation, Limited, a group of dyestuffs having the special property of dyeing Celanese silk. The discovery and developmsnt of new dyestuffs must take place if the British Industry is ultimately to take rank amongst the great dyestuffs manufacturers, and I feel confident that the future will see further important British discoveries.

Building up a British Industry

The building up of a British Dyestuffs Industry has always, by those who realised its vast nature and complexity, been acknowledged as a great task. So far progress has been well maintained, and no impartial person can review the past year's work without feeling that splendid results have been accomplished, but there is still some distance to go. It is not possible to accomplish everything at once. The German Dyestuffs companies are well organised, will equipped and well trained. The all-round efficiency of their industry before the war stood at a high mark. Perhaps it is not too much to say it was the most efficient industry in the world. Efficiency is chiefly expressed in prices. The year 1923 has shown a general fall in prices. The average price of dyestuffs during 1922 was 3s. 5d. a pound, whilst in July of this year a similar average was 2s. 6d., and to-day it is somewhat lower still. The vital necessity for economy and low cost of production and the utilisation of apparently waste products are fully realised, and no effort is being spared by the British manufacturers towards ultimately placing the industry in a competitve position, but so long as trade remains under the present cloud of depression, the advantages obtainable from regular and adequate output cannot, of course, be realised. There is no doubt that when the time arrives the British makers will not be found wanting in this respect.

In pursuit of this gospel of efficiency, the industry is extending in other closely allied fields. It has already stretched a helping hand towards those firms engaged in the task of establishing a British Fine Chemicals Industry.

The Industry has not been unmindful of the debt it owes to our Universities and Technical Schools, and, realising in full degree the necessity, if the Industry is to prosper, for such great schools of chemical teaching and research, it has done a great deal to supply some of the wants of the laboratories of these institutions. Recently the Industry has developed the manufacture of those out-of-the-way organic products which are finding an important use in the rubber industry as accelerators in the vulcanising process.

I cannot close this review of the year's work without expressing my confidence in the future. I have now for some time been privileged to know something at first hand of the British Dyestuffs Industry, and I have been at pains closely to study the requirements for success. All these essentials, in my opinion, we have. The English chemist, in training

and performance, will compare with any of his fellows. Research, a vital part of success, has been fostered and developed to an extent that no other industry in this country has done hitherto; the plant is modern, efficient, and carefully designed, and in so far as there are geographic factors in the problem, they are in our favour. The Dyestuffs Industry demands an intelligent co-operation between chemists, engineers, colourists, and commercial staff, and ultimate success depends on mutual helpfulness, ungrudging services, high enthusiasm, and the steady working towards a great ideal.

The Nitrogen Industry in 1923

By E. B. Maxted, D.Sc., Ph.D.

THE past year has, in many branches, been one of rather slow development, compared with the meteoric constructive enterprise of the later war years and of the years immediately following the Armistice. Considerations of expenditure have to a large extent taken the place of those based on national emergency or national protection; and progress in new directions has necessarily been controlled by trade depression and by the economies thereby imposed.

In the direction of nitrogen fixation definite if somewhat cautious, advance is being made in a number of countries, while in others the position would appear to be stagnant or obscure. Thus, in Great Britain, steady, unobtrusive progress is being made by Synthetic Ammonia and Nitrates, Ltd., at Billingham; and the erection of a plant for the manufacture of cyanogen compounds from atmospheric nitrogen is being undertaken by the British Cyanides Co. In France a synthetic ammonia factory having a capacity of about 36,000 tons per annum of fixed nitrogen is stated to be projected at Toulouse under the agreement with the Badische Company, the exact position of the Claude process, as far as large scale developments are concerned, being not generally known. In Italy considerable activity on a moderate scale is being developed; and a new system for the synthesis of ammonia, using water power for the generation of electrolytic hydrogen, is described below. In the United States the two large plants at Sheffield and Muscle Shoals, for the manufacture of synthetic ammonia and cyanamide respectively, are not, as far as the author is aware, being worked. In Germany the post-war capacity is stated to be 300,000 tons per annum of fixed nitrogen in the form of synthetic ammonia, in addition to 100,000 tons as cyanamide (see the article by H. E. Watts, THE CHEMICAL AGE, Vol. 9, p. 226), but actual production has, of course, been influenced by the present political and economical position.

Whether or not the above and similar enterprises outside Germany are sufficient to cover the national needs remains to be seen. In any case, the national aspect of the question should not be forgotten; and the steady actual or potential agricultural demand for nitrogenous fertilisers is always present. The author recalls discussing the nitrogen fixation question some time ago with a prominent foreign engineer, who put forward the view that a Government should prefer to spend even a relatively large sum on a nitrogen fixation plant, rather, for instance, than on a new battleship; since, whereas the latter might quickly be sunk in action, the nitrogen fixation factory would in any case provide security not only for increased food in peace time, but also for explosives during times of war, irrespective of possible isolation.

In view of possible more extensive competition from synthetic fixed nitrogen, the technical side of Chile nitrate extraction—as well as the system of export taxes under which cargoes of this are shipped—may possibly be revised. It is recognised that the present methods of extraction present many opportunities for improvement both technically and by suitable organisation of the officinas; moreover the tax referred to above represents a considerable proportion of the price of the nitrate. Further, with the introduction of improved and more complete methods of extraction, it becomes possible to extract poorer deposits. All these factors mean that Chilean nitrates may—if stringent cutting down of prices becomes necessary, owing to the development of synthetic nitrogen compounds—become available at considerably less cost than the present ruling prices; also that the supplies will not become exhausted in anything like as short a time as was previously thought.

Another important increase in the production of fixed nitrogen may probably be looked for in connection with methods for recovering an increased proportion of the nitrogen of coal in the form of ammonium salts. It is found that much of the ammonia originally produced during the carbonisation of coal undergoes decomposition on the hot wall of the retort or on the surface of the hotter portions of the charge itself. In this connection it has been emphasised (see THE CHEMICAL AGE, Vol. 8, p. 687) that, whereas processes such as that used in making Mond gas give 90 lb. of ammonium sulphate per ton of fuel, only about 25 lb. of the salt per ton are obtained in coke oven or gas works practice. An additional possible source of nitrogen compounds lies in the residues from large sewage disposal works. E. Ardern, C. Jephson and P. Gaunt (*J. Soc. Chem. Ind.*, 1923, **42**, 230T) have published interesting work on the possibility of recovering this nitrogen economically for agricultural use by means of the activated sludge process.

In the following sections, reference is made to a number of the more important papers and patents published during the past year and relating to the nitrogen industry.

Synthesis of Ammonia

An Italian system for the synthesis of ammonia, due to Fauser, has been described in detail (THE CHEMICAL AGE, Vol. 9, p. 28; *Giorn. Chim. Ind. Appl.*, 1923, **5**, 171). The procedure differs somewhat from the Haber and other similar systems, in that the water which is used to lubricate the compressors is also employed to separate the ammonia from the circuit gases. A Fauser plant having a capacity of 18 quintals per day has been erected by the Societa Elettrochimica at Novara. The hydrogen required for the synthesis is generated by electrolytic cells, which are of special construction in order to eliminate the possibility of the penetration of oxygen into the mixture compressed. This use of an electrolytic method is, of course, of considerable interest in Italy in view of its potential water power. Nitrogen is obtained apparently partly by combustion of this hydrogen with air and partly—by the same method—from the gases, rich in nitrogen, available from the ammonia oxidation plant attached to the installation. The working pressure used is 300 atmospheres; and it is stated that an expenditure of electrical energy equivalent to about 17 kilowatt-hours is required for the fixation, as ammonia, of each kilogram of nitrogen.

Further plant for the synthesis itself has been described by L. Casale and R. Leprestre (Brit. Pat. 193,789; THE CHEMICAL AGE, Vol. 8, p. 350). The furnace employed consists of three concentric tubes, the innermost of which is provided with heating elements, while the inner annulus contains the catalyst. The outermost tube is used for the absorption of excessive reaction heat by means of cool gases. Among the newer uses which have been suggested for the Plauson mill is its employment for the synthesis of ammonia (H. Harter and J. M. Meyer, Ger. Pat. 378,290, ex *J. Soc. Chem. Ind.*, 1923, **42**, 975A). The catalyst is disintegrated in the mill, through which nitrogen and hydrogen are passed. Owing to the fineness of division of the contact mass, it is stated to be possible to obtain a relatively rapid production of ammonia even at a moderate temperature and pressure. From an experimental and testing standpoint, a paper by A. T. Larson and S. Karrer (*J. Ind. & Eng. Chem.*, 1922, **14**, 1012), describing an automatic pressure regulating valve for delivering gas at a constant pressure from a reservoir at a variable higher pressure, is of interest. The valve is operated by an electromagnet, controlled by the motion of a Bourdon tube. The disposal of excessive reaction heat has, with the improved yields of ammonia now obtained, become a matter requiring careful consideration; and attention has been drawn in previous years to methods of doing this. L. Casale (Brit. Pat. 194,740; THE CHEMICAL AGE, Vol. 8, p. 432; see also U.S. Pat. 1,447,123) regulates the temperature of the synthesis automatically, when once this has begun, by partial absorption only of the ammonia in the circuit gases. In this

way the fresh ammonia formed during each passage through the catalyst is limited to that required to maintain the temperature required; and the possibility of an excessive rise is eliminated. In connection with the synthesis of ammonia, attention may be drawn to a paper by B. Heastie (*J. Soc. Chem. Ind.*, 1923, **42**, 443T) on the mathematical side of heat exchangers. The published treatment of this matter is rather scanty; and any fresh data such as these are to be welcomed.

Several catalysts containing ferro- or ferricyanides have been described during the year. Thus, the Norsk Hydro-Elektrisk Kvaelstofaktieselskab (Brit. Pat. 168,902) state that iron ferro- and ferricyanides form efficient catalysts for the synthesis of ammonia, provided that simple soluble iron salts are absent. The preparation of a compound catalyst, which is stated to be of high activity, is described by J. C. Clancy (U.S. Pat. 1,454,599, ex *J. Soc. Chem. Ind.*, 1923, **42**, 772A). A solution of barium and calcium ferrocyanide is evaporated in the presence of a pumice support, and slowly heated to reaction temperature in the presence of nitrogen and hydrogen. L. Casale (Brit. Pat. 197,198; THE CHEMICAL AGE, Vol. 8, p. 652) recommends the preparation of a catalyst by bringing iron into violent ebullition by combustion in oxygen, the operation being continued until about 5–10 per cent. of the oxidation product has been volatilised, the impurities being thus removed from the residue.

The advantages of coke oven gas as a raw material for the synthesis of ammonia have been discussed by Claude (*Compt. rend.*, 1923, **176**, 394). It is proposed to separate the hydrogen from this gas by a low temperature method, the gas being first subjected to preliminary purification to remove, for instance, the ethylene. Claude states that the total power required to manufacture ammonia by the method described is about three kilowatt-hours per kilogram of ammonia. In comparing this figure with that quoted for the Fauser system, it must be borne in mind that the latter method starts from water, whereas, for the Claude process, the figure given is based on the provision of a fuel gas. The purification of gases for the synthesis of ammonia is dealt with by de Jahn (U.S. Pat. 1,436,949), who employs sodamide as a purifying agent. Finally, the fixation of nitrogen from a general standpoint has been described by Kilburn Scott in a series of Cantor Lectures (THE CHEMICAL AGE, Vol. 8, pp. 401, 426, 459).

Other Methods of Nitrogen Fixation

The arc process is represented by a patent granted to Claude (Brit. Pat. 196,269; THE CHEMICAL AGE, Vol. 8, p. 652) for the application of a high working pressure to this method of nitrogen fixation, with the object particularly of facilitating the condensation of nitrogen peroxide by cooling. It is proposed to carry out the reaction by circulating a mixture of nitrogen and oxygen in a closed system alternately through an arc and through a condenser cooled to −10° C. The working pressure employed is from 100 to 200 atmospheres. E. Berl has contributed an interesting note (*Zeitschr. f. angew. Chem.*, 1923, **36**, 87) on an explosion which occurred in an arc plant at Bodio, in which nitrogen oxides were condensed by a low temperature method. It appears that this was caused by using a benzene hydrocarbon as a refrigerating agent, and by the leakage of this into the liquid oxides of nitrogen. Both benzene and toluene were found to form a highly explosive compound with nitrogen peroxide. The compounds are, however, decomposed by water.

C. J. Goodwin (Brit. Pat. 205,288, THE CHEMICAL AGE, Vol. 9, p. 549) has described the production of nitric oxide by the Häusser process, employing as raw material gases such as coke oven gas from which hydrogen has previously been partially or completely removed. In an experiment with coke oven gas, from which about 80 per cent. of the hydrogen had been removed, about 250 grams of nitric oxide per cubic metre were obtained, compared with 150–175 grams with the original gas. The process is specially adapted to using residues from low temperature hydrogen plants which operate by the separation of hydrogen from fuel gases.

A number of papers dealing with nitrogen fixation as cyanide or cyanamide have appeared during the year. Thus, while it is well known that the addition of an alkaline earth fluoride or chloride markedly assists the formation of calcium cyanamide from carbide and nitrogen, the effect does not appear to have been examined for the preparation of cyanide by the Bucher process. This has now been investigated by the du Pont de Nemours Co. (Brit. Pat. 200,902), who find that the time of reaction between carbon, nitrogen, and soda in the presence of iron is shortened considerably by the incorporation of sodium fluoride or chloride, probably owing to the action of this as a flux. An increased output of cyanide is also obtained by allowing the reaction to proceed to a stage at which the shrinkage of the charge is substantially complete, and adding sufficient fresh material to keep the retort filled to its normal capacity. It is stated that with a suitable charge, containing 5 per cent. of sodium fluoride, about 95–98 per cent. of the sodium carbonate used could be converted into cyanide in two hours at 900–950° C. Further work on the Bucher process has been carried out by F. C. Dyche-Teague, A. Wilson-Hughes and F. J. Commin (Brit. Pat. 192,791). A mixture of equal parts by weight of soda ash, carbon and iron oxide is incorporated with a small quantity of an oil containing sodium rosinate. The mass thus formed is stable mechanically and is not blown out by the current of gas. In fixing nitrogen by means of this material, it is stated to be beneficial to introduce hydrogen from time to time in place of nitrogen; or nitrogen containing a small percentage of hydrogen may advantageously be used. Plant for the fixation of nitrogen by the cyanide process is described by the Air Reduction Co. (Brit. Pat. 202,383; THE CHEMICAL AGE, Vol. 9, p. 318). In order to avoid the formation of channels, due to contraction, a special type of rotating furnace is employed, of such a nature that the reaction zone is maintained substantially full. As retort material, iron alloyed with nickel and chromium, either with or without silicon or manganese, is employed. An improvement in the plant used for carrying out the synthesis of barium cyanide is described in a patent of Woodall, Duckham and Jones (Brit. Pat. 194,026). The corrosion, which is the great drawback of this process, is avoided by carrying out the operation in a muffle, the roof of which is heated. Titanium nitrogen compounds are dealt with in Brit. Pat. 175,989 (Andreu and Paquet), according to which a mixture of titaniferous ore with carbon and sodium carbonate is heated in nitrogen. A somewhat analogous process is described by V. Gerber (Brit. Pat. 199,667; THE CHEMICAL AGE, Vol. 9, p. 101), in which aluminiferous substances such as clay are heated in an atmosphere of nitrogen with alkaline earth oxide and carbon. An interesting paper on the decomposition and stability of calcium cyanamide has been published by V. Ehrlich (*Zeitschr. f. Elektrochem*, 1922, **28**, 529). Calcium cyanamide, if pure, sublimes at 1,300° C., without melting; but under ordinary conditions decomposition also occurs. It is interesting to note that the melting point of calcium cyanamide is reduced to below 900° C. by the addition of 15 per cent. of calcium chloride, the use of this body in the formation of cyanamide being well known.

Ammonium Salts

The possibility of increasing the yield of ammonia in coke oven practice is dsscussed by R. A. Mott (*Gas World*, 1923, **78**, Coking Section, p. 12), particularly by reducing the decomposition of ammonia by contact with hot solids. The same author, together with H. J. Hodsman (*J. Soc. Chem. Ind.*, 1923, **42**, 41T) has published work on the influence of water vapour and of the nature of the contact material on this dissociation.

In previous reviews attention has been drawn to various processes for the production of neutral ammonium sulphate. This operation presents certain difficulties in small works, which difficulties are discussed in detail by a correspondent in THE CHEMICAL AGE (Vol. 8, p. 254). A further modification of a process for the preparation of neutral sulphate has been described by Pease and Partners and Stephenson (Brit. Pat. 197,724; THE CHEMICAL AGE, Vol. 8, p. 676). According to this method the ammonia for neutralising the sulphate is derived directly from the ammoniacal gases, in place of from a previously prepared solution of ammonia. Two further patents in connection with the drying of ammonium sulphate may also be mentioned. It is found that caking may be prevented if the hot lumps from the centrifuges are crushed and allowed to remain in a separated condition until cold (G. Weyman, Brit. Pat. 205,301; THE CHEMICAL AGE, Vol. 9, p. 549). Finally, R. Lessing (Brit. Pat. 199,475; THE CHEMICAL AGE, Vol. 9, p. 100) states that

discolouration of the impure sulphate can be avoided by drying previous to neutralisation.

Nitric Acid and Nitrates

Dealing in the first place with the formation of nitric acid by the oxidation of ammonia, this process has been studied by E. Decarrière (*Comp. rend.*, 1923, **177**, 186), employing palladium as a catalyst. The results are very similar to those obtained with platinum. Further work on the same process in the presence of an iron catalyst containing bismuth has been described by K. Inaba (*Bull. Inst. Chem. Phys. Res.*; ex *J. Soc. Chem. Ind.*, 1923, **42**, 886A). A catalyst of high activity was prepared by precipitating as hydroxides a mixture of 100 parts of ferric nitrate, 20 parts of bismuth nitrate, and four parts of thorium nitrate. I. Cederberg and H. Bäckström (Brit. Pat. 197,872; THE CHEMICAL AGE, Vol. 8, p. 676) describe a furnace for base metal catalysts, constructed in such a way that the temperature can be regulated at any point. In connection with the above reaction, it may be noted that aliphatic amines may be oxidised to nitric acid and carbon dioxide (H. Cramer and A. Reiffen, Ger. Pat. 377,521) in an analogous manner to the ordinary oxidation of ammonia.

According to a process for the absorption of nitrogen oxides described by the Officine Elettrochimiche and C. Toniolo (Ger. Pat. 364,521, ex *J. Soc. Chem. Ind.* 1923, **42**, 223A) a portion of the nitrous gases is absorbed in a water scrubber, and the residue, after being dried by means of liquefied oxides of nitrogen, is condensed at a low temperature. The dilute nitric acid produced in the scrubber is concentrated by means of the liquid nitrogen oxides thus produced.

In relation to the extraction of Chile nitrate from caliche, two papers may be mentioned. F. G. Donnan (*J. Soc. Chem. Ind.*, 1923, **42**, 440T) has discussed the mathematical side of leaching. In Brit. Pat. 192,032 (Guggenheim; THE CHEMICAL AGE, Vol. 8, p. 317) an improved process of leaching is described, according to which this operation is carried out by alternately heating the liquor in contact with the caliche and cooling it for the deposition of nitrates, heat exchangers being used in order to economise the amount of heating and cooling required.

Chemical Inventions of the Year

By Our Patent Correspondent

ANOTHER year has closed and once more a large mass of invention, running into many hundreds of published patents, bears witness to the vast amount of research in which chemists are engaged in every branch of chemical industry, and in allied industries. A short review of some of the more striking of these inventions, many of them as yet hardly beyond the experimental stage, will afford an indication of the lines on which chemical processes are developing, and of the progress which has been made.

Colloidal Dispersion

The study of colloidal chemistry and the application of the colloidal mill invented and developed by Plauson and others, has been considerably extended in the past year. It has been applied to the extraction of sugar from beet, which may be completely effected in two minutes in the mill, thus avoiding the large expenditure of power necessary in the usual process. Another application is the production of disinfectants from tar acids by emulsifying with water and a very small proportion of soap and free fatty acid. Such emulsions may be very dilute and even then their disinfecting powers are greater than those of strong solutions of tar acids. A strong insecticide and fungicide may be made by treating naphthalene or camphor with water in the colloid mill, the dispersion being assisted by the addition of small quantities of soap, fatty acid, gelatine, sulphosalicylic acid, or sulphonated castor oil. The mill should also be effective in cheapening the manufacture of lead arsenate, so largely used as an insecticide spray. The use of expensive soluble lead salts may be avoided, and litharge may be colloidally dispersed with water and then treated in the mill with arsenic acid. The resulting lead arsenate is more finely divided and more effective than the usual form.

Another interesting application of the colloid mill is in the separation of ores. It is found that different constituents of the ore are not dispersed in the same way, and at the same velocity, and the separation may be accelerated by adding a dispersator having an electric charge of the same sign and the same magnitude as the solid ingredient which is most readily colloidalised. This method has been used for the separation of chromium from manganese, for recovering zirconia, and for treating ores of silver, copper, tin, mercury, and manganese-iron. Patents have also been obtained for the application of the colloid mill to the manufacture of hard and soft soaps, edible oils (saponification of fatty acids), lubricants (neutralisation of animal and vegetable fats with lime or caustic alkali), and caustic soda from a milk of lime and soda ash.

Fixation of Nitrogen

Much work has been done on the fixation of nitrogen, more particularly as cyanide. In a process in which alkali and carbon are heated in nitrogen, the resulting gases containing cyanide are drawn off and passed over adsorptive carbon, which adsorbs more than its own weight of cyanide at 1,000° C. An increased yield is obtained. Another inventor improves this process by treating the charge with emulsified oil, free from sulphur. This prevents the carbon, and the iron oxide which is used as a catalyst, from being carried off by the gas, and a cyanide yield of 75—85 per cent. is obtained. The difficulty which arises in this process due to the corrosion of iron retorts or furnaces is overcome by another invention, by coating with an alloy of nickel, chromium, and small proportions of iron, manganese and carbon. Particles of the alloy are projected against the surface of the retort with very high velocity and become welded to it. In still another process, an increased yield is obtained by using carbon obtained by incinerating alkali-soluble constituents of wood pulp. This result is attributed to the absence of silica, alumina, sulphur and phosphorus in the carbon.

In the synthetic ammonia industry, invention has been mainly directed to the improvement of apparatus in details, and to the production of more efficient catalysts. In one case, an iron catalyst is obtained by melting iron or an iron alloy, and then boiling it violently by means of a jet of oxygen under pressure. If about 8—15 per cent of the oxidised product is volatilised, it is found that all impurities detrimental to catalysts are eliminated. In another invention, an alkaline earth metal or lithium is heated in ammonia or hydrogen, yielding either an amide or a hydride respectively. If mixed with lime or magnesia, heated *in vacuo*, and cooled in nitrogen, a nitride is obtained. It is possible by the use of these catalysts to obtain synthetic ammonia at atmospheric pressure.

Fertilisers

Considerable attention has been paid to artificial fertilisers, mostly in the direction of obtaining economies in manufacture. In one process ammonia is absorbed in substances such as peat, powdered coal or coke, preferably in a mixture of wet peat and dry coal, coke, or shale, which is saturated with phosphoric acid solution. A fertiliser rich in nitrogen and phosphate is thus obtained, which requires considerably less sulphuric acid in its manufacture than a corresponding fertiliser composed of ammonium sulphate and calcium phosphate.

Invention has also been active in the ammonium sulphate industry. In one invention, an ingenious apparatus is used to avoid the use of steam for liberating ammonia from the ammoniacal liquor, with its consequent heat losses. Hot air is used for this purpose, and the same apparatus also neutralises and dries the ammonium sulphate. The cause of the brown colour which commercial ammonium sulphate is liable to have, has also been investigated and has been found to be due to moisture which is present when the salt is neutralised. If ordinary ammonium sulphate containing all the usual impurities, including iron salts, is dried and treated with any dry neutralising agent, the brown colour does not appear. The drying must be more effective than that obtained by centrifuging or draining, and must be effected by heat, and further, the purified salt must be kept dry. The neutralisation may

be partly carried out when the salt is wet, but it must be dried before the neutralisation is completed.

Indiarubber

The factors governing the vulcanisation of indiarubber and the use of chemical additions to accelerate vulcanisation have been the objects of much research. New accelerators recently patented include thiuramidsulphide containing substituted alkyl and aryl groups; quinone; and the product obtained by treating an open carbon chain aldehyde having 2—8 carbon atoms in the chain, with ammonia. Suitable aldehydes are heptaldehyde, propionaldehyde, cinnamylaldehyde, iso-valeraldehyde. Another invention uses cyanamide or di-cyandiamide, and it is found that an admixture of equal parts of sulphur and di-cyandiamide reduces the time of vulcanisation to one half. In another case tri-substituted thioureas, especially phenyldimethyl-thiourea and phenyl-penta-methylene-thiourea are used, and other inventors use accelerators composed of anhydrous zinc or cadmium sulphate and ammonia, or butyraldehyde-ammonia. One of the difficulties in vulcanisation is that vulcanisation continues as long as any sulphur is present, and over-vulcanisation may take place. The conditions have now been found whereby vulcanisation may be stopped at any desired point, any excess of sulphur remaining in the uncombined condition even though heating is continued. This is effected by using certain specified mixtures of sulphur and zinc or cadmium propyl xanthates, or the corresponding ethyl, butyl or amyl xanthates. The vulcanisation temperature is about 110° C., and the resulting rubber is of increased strength.

In another case the vulcanisation of a mixture of rubber, sulphur and oxide of zinc, aluminium, lead or manganese is assisted by adding acids which promote the solution of the oxide in rubber. Such acids are those whose zinc salts are soluble in hot aromatic hydrocarbons such as benzene or xylene, or terpene hydrocarbons, such as pinene or dipentene. Lauric, palmitic, stearic, oleic or linoleic acids may be used. In an invention for obtaining a vulcanised rubber solution, the solution is vulcanised by the Peachey process or by sulphur chloride, or sulphur. This solution gels in a short time, but if a rubber precipitant such as acetone is added, a rubber dough containing very little solvent is obtained. This may be dissolved in benzene, and a solid vulcanised rubber obtained by evaporating the solution. Another inventor obtains a colloidal suspension of vulcanised rubber suitable for impregnating fabrics without solvents, by vulcanising the latex with sulphur and preventing coagulation by adding sodium sulphide, ammonia or piperidine.

Dyestuffs, etc.

Numerous new dyestuffs have been patented in the past year, and among other features may be noticed several inventions for overcoming the lack of affinity of cellulose acetate artificial silk for many of the usual dyestuffs. These experiments indicate that it is necessary to render the dyestuff soluble in water, but not insoluble in organic solvents. Suitable dyestuffs are aminoazo dyes which contain carboxylic acid groups, but no sulphonic acid group. In another case, the lack of affinity for direct or acid colouring matter is overcome by using insoluble or difficultly soluble azo colouring matter in the form of water-soluble bisulphite derivatives. In other cases the fibres are subjected to surface saponification at low temperatures to increase their affinity for the dyestuff.

Another process of interest relates to the chlorination of organic compounds which at present are only chlorinated with difficulty. The chlorination is effected by treating the compound with sulphuryl chloride in the presence of aluminium chloride, sulphur, or sulphur chloride, or any compound which yields sulphur chloride. This process is applicable to compounds such as paradichlorbenzene, anthraquinone, indanthrene, naphthalene, etc. In another invention the problem of reducing organic compounds with alkali amalgams is investigated, with a view to overcoming the difficulty of securing intimate contact between the organic compound and the amalgam. Aqueous solvents for the organic compound have been found, which enable the resulting alkali to be recovered, and their solubility in water is sufficiently decreased in the presence of alkali to cause them to separate as a separate layer. Such solvents are water-soluble cyclic bases containing nitrogen within the ring—*e.g.*, pyridine and piperidine. An apparatus suitable for carrying out such reductions has been described, applicable to *o*-nitroanisol yielding anisidine and azoanisol, to azoanisol yielding hydrazo-anisol and anisidine, and to nitrobenzene yielding hydrazo-benzene, azobenzene and aniline.

A process of general interest relates to the oxidation of hydrocarbons in gaseous form by means of oxygen in the presence of a catalyst consisting of an oxide of boron or phosphorus, to intermediate products such as aldehydes or ketones. By this means ethylene, acetone, or ethyl alcohol may be treated with oxygen under certain conditions, yielding formaldehyde. Air containing 2 per cent. of anthracene may be oxidised to anthraquinone, and benzyl alcohol to benzaldehyde.

Pigments

Much research work has been done on pigments, particularly white pigments. Experiments on lithopone show that its covering power depends on the relation between the amount of chlorine present during precipitation and the temperature at which the crude lithopone is heated in a muffle. It is found that if the proportion of chlorine decreases, the muffle temperature must be increased. There is also a temperature which gives the best light-resisting quality, which temperature increases more rapidly than the critical temperature corresponding to the chlorine proportion. Combining these facts, a lithopone of good covering power and light-resisting power is obtained by heating at 800° C. The conditions covering the oil absorption of the lithopone have also been fully investigated.

Titanium pigments have also been improved, in one case by hydrolysing titanium sulphate at 170° C. Another invention overcomes the difficulty of obtaining titanium sulphate from minerals having a small titanium content, by making the mineral into a paste with sulphuric acid and then heating to 300° C. in a muffle. Other inventions deal with the elimination of iron in the production of titanium oxide from ilmenite.

Another invention which appears to promise considerable economy in manufacture relates to the use of extenders such as barium sulphate, calcium carbonate or silica. Pigments thus made by a simple mixing have a diluted pigmenting power depending on the proportion of extender, but if the pigment is made by co-precipitation of the ingredients a better pigmenting power is obtained. The same effect can be more cheaply obtained by heating a mechanical mixture of pigment and extender until the particles adhere, but not fuse; 5 per cent. of a binder such as cryolite or felspar may be included. White lead may be extended with double the amount of calcium carbonate in this way, and the product is a pigment equal to white lead alone. The same process can be applied to pigments made from oxides of titanium, tin, or zinc.

Catalysts

Many patents relate to the manufacture of catalysts with a view to increasing their activity. A process which can be applied to tin, ferro-titanium or ferro-vanadium, consists in vaporising the metal or its carbide in the electric arc, and electrostatically precipitating the fumes. These catalysts are very active.

It is generally known that nickel wire, turnings, plates, etc., are not so active in the hydrogenation of oils, as finely divided nickel obtained by precipitation from nickel salts, followed by reduction in hydrogen, but a process has now been discovered by which the former may be made equally active. The nickel turnings, etc., are packed in asbestos cloth and made the anode in an electrolytic cell having a nickel cathode, and containing an electrolyte of sodium carbonate of 1—5 per cent. strength. The anode becomes blackened and is then washed, dried, and reduced in hydrogen for 30—60 minutes. This catalyst is as effective as nickel powder and remains active for several weeks when used for hydrogenating oils.

Purifying and Cracking Oils

Several new processes have been patented for the recovery of the aluminium chloride from residues obtained during the treatment of high boiling point oils to obtain low boiling point oils. In a new process for cracking oils, the oil is circulated through the apparatus with a solvent oil of lower boiling point which remains uncracked and unvaporised at the pressure in the system. By this means the heavy residues may be kept in solution in the solvent oil, and no deposition of carbon or tarry residues takes place. In an invention

for refining mineral oils, petroleum, benzene, etc., the use of concentrated sulphuric acid is dispensed with, and sodium or potassium bisulphate or pyrosulphate is used instead. The saturated hydrocarbons are not attacked. Another inventor investigating the problem of purifying oils by means of metals such as copper, zinc, cadmium, or iron to remove sulphur, finds that the affinity of these metals for sulphur depends on the presence of an oxide or chloride of the metal. In another case oil is desulphurised by atomising it in ammonia gas, or in contact with suspended finely divided oxides.

Production of Organic Compounds

Several inventions deal with the synthesis of organic compounds. Thus, formamide is produced by heating liquid ammonia and carbon monoxide to a pressure of 150 atmospheres in an autoclave, and purifying the resulting formamide by distillation. Formic acid may be produced by the oxidation of methane with a metallic oxide, or by the interaction of carbon monoxide and water vapour in the presence of a metallic oxide. The formic acid may be used in the distillation of carbonaceous material to increase the yield of condensible hydrocarbons.

The production of cellulose ethers and esters, and their conversion into artificial silk, films, etc., continues to receive considerable attention, and several new ethers of a high degree of etherification have been obtained, while much detailed investigation relating to the production of cellulose acetates of improved qualities have been made. In one process, cellulose is acetylated by means of gaseous acetic anhydride with hydrochloric acid gas or sulphur dioxide as catalyst. The cellulose may be in the form of fibres, and if the acetylation extends only to about one-third of their thickness, a product resembling wool is obtained. If the treatment is continued until about two-thirds of the fibre is affected, the product resembles hair. Several inventions deal with details in the manufacture of viscose, notably with a view to avoid the necessity of "ripening" it.

General

With the whole field of chemistry so well covered by many hundreds of inventions in the past year, it is somewhat difficult to select those of outstanding merit and originality, but among others may be noticed a process for absorbing oxygen from the air by means of hæmoglobin, the constituent of blood which normally carries out this function. The oxygen is subsequently liberated at a different temperature and pressure, and the invention shows how some of the difficulties which occur when the extraction of oxygen from air is attempted by this method may be avoided. The difficulty of avoiding under or over-heating of phenol formaldehyde condensation products such as Bakelite in the hardening process, may be overcome according to an ingenious invention, by adding a small proportion of colouring matter, which changes colour permanently at the desired hardening temperature. Methyl violet and auramine yellow are examples of such materials. The colour of the product thus affords a permanent indication of whether the material has been heated throughout to the necessary temperature.

The separation of mixtures of liquids having similar boiling points has usually presented difficulties, but these are overcome in one invention by passing the mixed vapours through a porous diaphragm having a different electric potential from that of the vapour to be separated. Mixtures such as alcohol and a hydrocarbon may be separated by this means. In another invention with the same object, the mixture of liquids is covered with a thin film of another liquid, preferably an oil, in which they are soluble to different degrees. The space above the oil will contain the vapours of the constituents, and if a current of air passes over the surface of the oil, it will be charged with the vapour of the constituents in proportion as they are soluble in the oil, and not in a proportion which is any way dependent on their boiling points. It is thus possible to extract a constituent having a higher boiling point from its mixture with a lower boiling constituent, provided the solubility of the former in the covering film is greater than that of the latter. An extremely small solubility in the covering film is sufficient. This process is suitable for separating mixtures such as acetic acid and water.

An invention which overcomes many of the difficulties in the concentration of minerals by flotation makes use of the discovery that any mineral may be floated if the particles are coated with oil in a thick pulp having a low surface tension, and then propelled to the surface of a liquid having a high surface tension. The tension of the pulp is lowered by heating or adding sodium sulphide, nitre cake, sodium carbonate or chloride, certain oils, or soluble soaps. The coating oil may be petroleum sludge, and the mixture is agitated in water.

Many inventions deal with the purification of various gas works by-products, the low-temperature distillation of coal, the concentration of ores, and recovery of metals, particularly copper, zinc, and precious metals, the purification of clay by peptisation for use in treating edible oils, and the improvement of furnaces, electrolytic cells, stills, centrifuges and other apparatus and plant which is in use in every branch of chemical industry.

Low Temperature Carbonisation

Extension of "Coalite" Plant at Barnsley

From a scientific point of view (a correspondent writes) it is admittedly wrong to burn raw coal and consume as fuel all the complex organic compounds, roughly represented by the volatile content, that have taken millions of years to be formed in the earth from the original vegetable material. The idea of carbonising coal—that is, heating it in closed vessels so as to decompose this volatile content and separate the gaseous and liquid products—can of course be traced back to Van Helmont in 1600, whilst various other early investigators, such as Thomas Shirley, Robert Boyle, Stephen Hales and J. Clayton were also associated with the general principle. Coal was also carbonised on quite a large scale as early as 1750 for the specific purpose of obtaining metallurgical coke, the by-products being wasted. As is well known, however, the pioneers in the high-temperature gas process were William Murdoch in Great Britain, who lighted his house in Redruth, Cornwall, in 1792, and Le Bon, in France, at approximately the same time. The gas industry was in its early days simply concerned with the production of as much gas as possible, and it was not until many years later that the value of the by-products was realised.

The idea of low-temperature carbonisation—roughly, to carbonise the coal at a carefully regulated lower temperature so as to give a much less drastic decomposition of the volatile matter with the maximum liquid paraffinoid compounds, as opposed to the benzenoid tar of the high-temperature processes, the gas works, and the coke oven—did not, however, take definite shape until three-quarters of a century after the commencement of the gas industry. Many very early investigators had pointed out the unscientific nature of the almost complete destruction of the volatile matter, but the first man who systematically investigated low-temperature carbonisation was Thomas Parker, who commenced operations at Wednesbury, near Wolverhampton, in 1901, the inauguration of the "Coalite" process. After many years of grappling with the many practical difficulties of the process, Low Temperature Carbonisation, Ltd., are now greatly extending their plant at Barugh, near Barnsley, so as to be capable of a throughput of 500 tons of raw coal in 24 hours.

In the "Coalite" process of simple low-temperature carbonisation at 1000° F., one ton of average semi-bituminous coal (25-30 per cent. volatile matter) gives—when the latest improvements in the process are embodied—4,500-6,000 cubic feet of very rich gas (700-825 B.Th.U. per cubic foot), 18-20 gallons of paraffinoid low-temperature tar, 3 gallons of motor spirit, 15 lb. sulphate of ammonia, and 14 cwt. "Coalite," which contains 8 per cent. volatile matter, being therefore smokeless and at the same time igniting easily, gives a cheerful fire, without smell, and having a high radiant efficiency.

Apart from the formidable practical difficulties there is the question of the cost of production—that is to say, whether, in competition with raw coal, the expense of the various operations will give sufficient profit from the sale of the various products. It is now stated that "Coalite" can be sold at the same price as raw coal. It is understood that the intention is to erect 500 ton unit "Coalite" plants in various industrial centres in order to supply the local market, so that something serious at last would appear to be in hand in connection with the commercial application of low-temperature carbonisation.

The British Fine Chemical Industry

Its Progress and Present Position

WHILE this country had a small but efficient fine chemical industry before the war, the greater part of the much larger industry which exists to-day was established either during the war, when a number of factories were built to turn out the products which had previously been obtained from Germany, or immediately after the war as a result of the promised protection which materialised in the Safeguarding of Industries Act. From the outset technical difficulties were encountered in the adaptation of little-known or badly-described text-book methods to commercial production. This difficulty has had to be overcome in the case of nearly every fine chemical product before it could be manufactured for sale, and progress in this direction has been continued throughout the past year by the majority of manufacturers. Some figures which were recently announced by one firm as to the number of their products show clearly that this work is being pushed forward vigorously, since they manufactured only 70 fine chemicals in 1913, increasing to 430 by 1920, and they now make no fewer than 1,200.

The Production of Insulin

The discovery of insulin, the much discussed specific for diabetes, by Dr. Banting has thrown much work on some of the fine chemical manufacturers during the year, for as is now well known, the treatment of this disease requires frequent injections of insulin, and the effect being only temporary, a regular and continuous supply is necessary. The preparation of this product, which is of a more biological nature than is usual in fine chemical works, requires large quantities of the fresh or frozen pancreas from rabbits, sheep, or other animals. Though at first much criticism was published in the Press against the slowness of British manufacturers in making insulin available, the difficulties were overcome with remarkable rapidity, particularly in view of the newness of the processes involved. It is now some months since regular supplies of insulin became available from such firms as the British Drug Houses, Ltd., Burroughs Wellcome and Co., and Allen and Hanbury's, Ltd. In the case of the first-named firm, for instance, a special building has been erected solely for the production of insulin, and up to the present over one million doses have been produced by this firm alone. With regard to the cost to patients, this has now been brought down to the reasonable figure of about £1 per week.

New Products Available

Progress has also been made all round in the manufacture of other medical chemicals. Organo-arsenic compounds have come in for considerable attention, and more than one firm has recently placed on the market preparations which are a considerable improvement on the earlier arsenobenzol bodies. Early in the year, for instance, Boots Pure Drug Co., Ltd., produced, under the name "Stabilarsan," a compound of salvarsan and glucose which has the advantage that it is supplied in solution form ready for use. Other fine chemicals of medicinal value that have been produced by some British firms for the first time during the past year include pure glucose and lactose, neutral acriflavine, chloral hydrate, acetylsalicylates, glycerophosphates, and lithium salts. The range of pure alkaloids has also been increased in some cases.

Reference must also be made to the work done by Boots Pure Drug Co., Ltd., the British Drug Houses, Ltd., and others, in increasing their range of pure research chemicals, which are used for laboratory work, and in many cases sold with a definite statement of the degree of purity. The British Drug Houses, Ltd., who devote their attention so largely to the biochemical aspects of the fine chemical industry, have produced during the year a good series of standard stains for microscope work. The work of the same firm in producing a range of special indicators for hydrogen-ion determinations has been continued, and several notable additions have been made to the series.

Another feature of interest is the resumption of the manufacture, by Messrs. Boots, of saccharin and chloramine-T., which is considered to be one of the most valuable disinfectants known at the present time. As a result of this, and as but one example of the interdependence of fine chemical production, supplies of ethyl and methyl toluene sulphonates have been once more available in good quantity.

With regard to essential oils, the progress has also been steady, but not so rapid as in some directions. Nevertheless, at the present time one of the firms extracting these oils is producing in tons products which they could only supply in ounces four years ago. The essential oil of garlic mixed with water, which was placed before the medical profession in 1916 as an internal antiseptic under the name "Yadil," has proved successful, and has been released for public use this year. This has entailed considerable developments on the part of the manufacturers, Clement & Johnson, Ltd.

The production of photographic chemicals, and developers in particular, has been well maintained, but not markedly advanced during the past year, the greatest expansion in this direction occurring during the war, it then being of vital necessity that these products should be manufactured in this country in order to keep up the supply. The production of the valuable organic developers, such as metol and hydroquinone being successfully accomplished, there is less progress to be made, and the past year has not been marked by any new developments, although research is still going on with photographic chemicals. Much work has, however, been done in connection with the photo-sensitising dyestuffs in the research laboratory, * and these have been applied further in the improvement of colour-sensitive plates.

Expansion of Factories

The continued increase in production which has characterised the past year in most branches of fine chemical manufacture has necessitated large developments in the factories of most firms. Since the war ended several firms have increased the size of their works so that they now occupy three or four times the area covered in 1918, in one case the figures being 200,000 cu. ft. in 1918 and 700,000 cu. ft. at the present time. A firm who specialise in photographic chemicals and were simply in the position of dealers before the war now own a factory capable of supplying all their needs, and though this has not been developed during the past few years, the full staff continues to be employed in spite of the strong competition there has been from foreign goods in this direction.

In addition to the technical difficulties of production, a number of other obstacles have had to be surmounted, which have come not so much in the province of the research staff as the executive staff. Apart from the financial difficulties necessarily associated with the general business depression, which have not affected fine chemical manufacturers unduly, there is one special difficulty which has affected many producers, but which has now been overcome to a considerable extent. We refer to the Excise facilities for the use of duty-free alcohol for chemical manufacture. The Customs authorities have now permitted, in special circumstances, the use of duty-free ethyl alcohol in restricted quantities under conditions which do not require the continual presence of an officer or the use of a locked receiver for the recovered alcohol. Where large quantities of alcohol are employed they have permitted the use under less onerous restrictions than formerly of special denaturants suited to the manufacturers' requirements. In the same connection there is a difficulty which still needs to be overcome, namely, the price of alcohol, which, owing to the distillers' monopoly, is kept very much higher in this country than in America, France, or Germany.

The Effect of the Safeguarding Act

No review of the present position of the fine chemical industry in this country would be complete without some reference to the Safeguarding of Industries Act, which was designed specially to foster this industry among others. In the first place it is evident that the fine chemical industry is in a fairly healthy condition, particularly in view of the general state of trade, but this must not necessarily be assumed to be a result of the Safeguarding Act without making further investigations. In answer to questions put by THE CHEMICAL AGE to a few typical manufacturers, all agreed that their position would be

* THE CHEMICAL AGE, Vol. ix., p. 250 and p. 302.

appreciably more difficult were it not for the existence of the Act, although the actual opinions as to its value were very varied. One firm stated that owing to the depreciated currencies of their foreign competitors, the effect of the duty was practically negligible, but that in spite of this a ready sale was found for their products which were equal to those of the best Continental makers. Another firm, though giving a similar reply, added that the Act had, however, proved of very great value, firstly by steadying prices, but chiefly because those manufacturers who had been able to take a long view of the situation and to see that the German policy of inflation could not continue indefinitely, had persisted in their developments. Another firm of manufacturers stated that the effect of the duty on the balance was all-important, as it just provided sufficient margin to enable them to market their products at a competitive price and return a small profit. In comparing these results it must be remembered that they apply to manufacturers of different products, and that the duty on products of high intrinsic value, being *ad valorem*, provides the home manufacturer with a much greater margin to pay his production expenses and counteract the debased currency of foreign competitors. Where the intrinsic value is small the duty is negligible, and in some such cases the home producer has had temporarily to abandon the manufacturer of such substances. There is ample evidence, however, that when foreign currencies and production costs become stabilised it will be on a higher level, and competition in the low-value chemicals will cease to be acute. The Safeguarding of Industries Act, it is claimed by supporters of the Act, will then become much more effective in enabling manufacture to be developed.

W.-J.

Developments in Heavy Chemicals

By P. Parrish, A.I.C.

THE anticipations entertained at the early part of the year of an improvement of trade have not been realised. The attitude of France in occupying the Ruhr, while affording increased trade in certain directions, has not generally helped the industrial position. The greatest need to-day is a return to peace, in order that normal activities throughout Europe, and indeed the world, can be resumed, and opportunity provided for the application of improved methods and new processes.

Heavy Acids

Sulphuric Acid.—In this connection there is nothing peculiarly novel to record, either in the matter of practice or of new plant. Spent oxide is still being used in substantial quantities, and there has been a sensible increase in the employment of Sicilian thirds sulphur. This has resulted in the adoption of mechanical rotary sulphur burners, which are very economical to operate in point of labour.

There is no development in the combination acid plant [1] meriting notice, although such plant is replete of possibilities. A growing number of water sprays have been introduced to sulphuric acid plants, and the popular method of elevating circulating acid is being gradually replaced by direct pumping. The Ferrari's pump is being largely adopted.

The history of the evolution of the tower chamber [2] which has culminated in the Mills-Packard water-cooled tower system, was the subject of a contribution during the year. The publication of some of the books comprising the fifth volume of [3] Lunge's Classic Edition of Sulphuric acid and Alkali, deserves mention. A development which the future may witness will be the erection of small units of sulphuric acid plant, consisting of about six packed towers of smaller dimensions than hitherto known, one working as a Glover, and one as a Gay Lussac, operated on much the same lines as the O.P.L. system. It is known that such plant can be erected at a low capital cost as contrasted with existing plants. Whether the adoption of high gaseous pressures, which are known to favour the intensive production of sulphuric acid, as has been revealed by the experiments by [4] Professor Guye at Geneva University, are likely to be promptly adopted, depends essentially on the suitability of the materials selected. It would appear that a number of comparatively small chamber units will be imperative.

Hydrochloric Acid

Some interesting particulars concerning the Cheshire salt industry were furnished in a lecture by [5] Mr. W. J. Lewis at the Birmingham University. Why the employment of gas firing in connection with saltcake furnaces has shown no progress [6] during the last twelve months is somewhat inexplicable, having regard to the better control which this method affords, and the greater economy to be gained thereby. The ordinary combustion of coke in connection with these furnaces is impracticable, on account of local heating, due to the shortness of the resulting flame. Coal, or a mixture of coal and coke, must be used. In Germany, the Zahn special gas producer is being largely employed. The saltcake pot is generally worked independent of the furnace, although heated by the surplus heat from that source. A continuous feed of sulphuric acid and salt is arranged, and the nitre cake is run off continuously, and granulated by a special device. Thus the nitre cake is in a peculiarly suitable condition for admixture with the salt, and the furnacing of the mixture is rendered less difficult. The final saltcake is friable, and of uniformly good quality.

Nitric Acid and Nitrates

A growing number of Ostwald ammonia-oxidation plants continue to be installed at sulphuric acid works. Some interesting notes concerning the Butters [7] nitrate process have been published. The view is now generally held [8] that cyanamide *per se* as a fertiliser does not appeal to the farmer, and the sale of this product as such is likely to diminish. It will, however, continue to find a market in mixtures. An extension of sales cannot be looked for unless some process is evolved by which cyanamide can be converted cheaply to some other useful form of fertiliser, such as urea.

Superphosphates

An interesting article, indicating developments in the manufacture of calcium superphosphate, was contributed by Mr. Alex. Ogilvie [9]. The tendency is for finer grinding, which assists in a reduction of the quantity of sulphuric acid to be used. The resultant superphosphate is drier, and contains less free acid. Investigations suggest that rapid and intimate mixing is essential with a quick discharge from the den. An excavator should ensure fine cutting, together with maximum aeration. Only in this way can the best product be produced. Attention has been prominently directed to a new compound fertiliser [10]—N.P.K.—derived by using a porous medium, impregnated with dilute phosphoric acid, to which potash has been added in suitable quantity, for absorbing ammonia from crude coal or coke oven gas. By this method Mr. Pease, the inventor, claims a substantial saving of sulphuric acid, and a more homogeneous product. It has been pointed out [11] that the economics of this process are none too sound, and that several of the claims have been placed too high.

Synthesis of Ammonia

Some of the results of the operation of the Claude process at the Béthune collieries have been furnished [12]. At this plant the gases on leaving the debenzolising apparatus are compressed to approximately twenty-five atmospheres. Subsequently they are variously treated in a series of towers. The hydrogen recovered is sent to a gasholder; the other gases, of high methane content, apart from ethylene, which can be recovered separately, are returned to the coke oven plant for utilisation. The cost price of hydrogen by this process is reputed to be very low. Of considerable interest

[1] THE CHEMICAL AGE, Vol. 8, p. 25.
[2] *Ibid.*, Vol. 8, p. 692.
[3] *Ibid.*, Vol. 8, p. 560.
[4] *Helvetica Chem. Acta*, June, 1923.
[5] THE CHEMICAL AGE, Vol. 8, p. 427.
[6] *Ibid.*, Vol. 9, p. 32.
[7] *Ibid.*, Vol. 8, p. 90.
[8] *Ibid.*, Vol. 8, p. 85.
[9] THE CHEMICAL AGE, Vol. 8, p. 690.
[10] *Ibid.*, Vol. 9, p. 140.
[11] *Gas World*, Coking Section, August 4–September 1, 1923.
[12] THE CHEMICAL AGE, Vol. 9, p. 121.

is the account of the synthetic ammonia and nitric acid plant established at Novara, in Italy [13]. Resembling very closely the Haber and Claude processes in principle, the outstanding features are the utilisation of waste and the avoidance of the expensive liquid air plant for obtaining nitrogen required in the ammonia synthesis. Nitrogen is derived from the residual gases after oxidation of ammonia to nitric acid. The producing stage [14] at Billingham, where the Haber process has been installed, is reported.

Ammonia and Ammonium Compounds

Still greater quantities (about seventy per cent. of the total make) of neutral sulphate continue to be made. Two important questions have been raised during the year: (*a*) [15] difficulties in the production of neutral sulphate at small works, and (*b*) [16] the caking of sulphate of ammonia. As regards small works, it has been pointed out that a better quality of acid-containing salt is necessary. To accomplish this, attention must be given to the saturator conditions, and the use of a centrifuge is necessary, quite apart from the final apparatus for drying the salt. It has also been suggested that the larger works should act as refiners for the smaller works—a proposal not without merit. The caking of sulphate of ammonia is a large question. Complete neutrality, freedom of the salt from foreign matter, greater crystal size, and storage under conditions where deposition of moisture (dew) is impossible, are the chief factors to which attention should be directed. It has been found that [17] thoria sensibly increases the yield of urea when ammonia and carbon dioxide are brought together in a heated tube. Several practical considerations still militate against the application of the method as at present known, but it is conceivable that some catalytic method, effected at ordinary pressures, will finally be evolved as a permanent solution of this problem. A process for the cheap production of urea is badly needed.

Chlorine and Hypochlorites

Notes on the handling of compressed gases, with special reference to chlorine, have been given in a paper by Dr. Risteen[18]. The electrolytic method for the production of a weak solution of hypochlorite from a solution of common salt still continues to increase. Many plants have been installed by local authorities for the manufacture of this product as an antiseptic.

Cyanides

Increasing quantities of ferrocyanides have been extracted from spent oxide during the current year. It is known that [19] the Bucher process is being erected in Holland. The success of the Barium process for the manufacture of cyanides was announced at the annual meeting of the British Cyanides Co., Ltd.

Hydrogen Peroxide

The manufacture of hydrogen peroxide, as principally carried out in this country, certainly comes under the category of the heavy chemical industry. Some interesting notes concerning hydrogen peroxide as a bleaching agent, its advantages, and suitable apparatus in which to effect such bleaching, are to be found in a paper by Weber.[20]

Soda and Potash Salts

This year has witnessed the celebration of the [21] alkali centenary, and the [22] jubilee of Brunner, Mond & Co., Ltd. The development of the alkali industry constitutes a story of captivating interest, to which very little more than passing notice can be given in this review. The Leblanc process [23] conceived in revolution, fathered by war, and nourished in strife, involved several stages. Firstly, the production of hydrochloric acid and saltcake from sulphuric acid and salt; secondly, the conversion of saltcake (largely sodium sulphate) to black ash, by furnacing in rotary furnaces with limestone and fuel; thirdly, the production of alkali by the lixiviation of the black ash and suitable purification of the leach liquor, and its evaporation; and fourthly, causticising, involving the treatment of soda ash with milk of lime, and the evaporation of the filtered weak caustic soda liquor.

Out of the Leblanc process there arose a variety of other operations, notably the Weldon and Deacon processes for the production of chlorine from hydrochloric acid, the Chance process for the recovery of sulphur from alkali waste, and the production of sodium sulphate from saltcake and/or alkali waste. Curiously enough, the celebration of the alkali centenary marked the demise of the Leblanc process as such; the saltcake stage is alone now operated to any appreciable extent. Succinctly stated, the Leblanc process has been supplanted by one involving the electrolysis of a solution of common salt, which process yields, in addition to the primary product (caustic soda), chlorine and hydrogen, both of which can be recovered separately, or they can be combined by combustion to produce synthetic hydrochloric acid. The [24] jubilee of Brunner, Mond & Co., Ltd., which must be connected with Solvay's ammonia-soda process, was celebrated in a fitting manner. There is one special feature which emerges at this epoch. In much the same way as the Solvay ammonia-soda process threatened the extinction of the Leblanc process fifty years ago, so does the electrolytic caustic soda process constitute a menace to the life of the ammonia-soda process to-day.

A new process for the manufacture of sodium thiosulphate was the subject of a paper by [25] Hargreaves and Dinningham. By the method outlined it is possible to obtain a solution of thiosulphate of sufficient concentration to crystallise without evaporation being necessary. A paper by Professor Hinchley [26] dealt with a new source of potash—leucite—the possibilities of which are wide, and need to be closely investigated, if for no other reason than to extend the British chemical industry in spheres of activity hitherto hardly touched.

That the New Year will bring an improvement of trade, and admit of the introduction of new processes, and new activities, is fervently to be hoped.

Crosfield's New Insurance Scheme

In the staff magazine of Joseph Crosfield and Sons, Ltd., Warrington, particulars are published of a new scheme of unemployment, sick benefit, and life insurance which the directors are introducing in the New Year.

The first of these has reference to Life Insurance. Every co-partner will be given, entirely free and without medical examination, an insurance policy for at least £100. The company will pay the premiums to keep up this policy as long as co-partners remain in the service of the firm, and even upon their retirement, the company may give consent to the policies being maintained by the holder taking over the payment of the premium. The amount of policy granted by the Board will be assessed both on the manner in which co-partners carry out their daily duties, and on their general disposition of loyalty towards, and interest in the firm, so that by diligence and loyalty co-partners may have their policies increased from time to time. The advantages of such a life policy are too obvious to require mention here, but for the married workers in particular, the feeling of security that in the event of death their relatives will be well provided for, will surely mean the lifting of a great load of anxiety from their minds.

In the case of sickness, co-partners who are away ill for more than six days will have the State contribution under the National Health Insurance Act added to by the firm so as to bring the total amount up to half their standard wages. Such a payment will be continued during four weeks' sickness. Amounts received through other sources than the State Insurance Scheme will not be taken into account in making the firm's contribution. Similarly with co-partners who are unemployed owing to slackness of trade, the grant made by the State will be supplemented by the firm when necessary, so as to bring the total received up to half the standard rate of wages. An even more substantial benefit contemplated is the payment of half wages for all short time. It is believed that these payments will be of great assistance in helping workers to tide over the difficult times caused by trade depression.

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[13] THE CHEMICAL AGE, Vol. 9, p. 28.
[14] *Ibid.*, Vol. 9, p. 574.
[15] *Ibid.*, Vol. 8, pp. 252, 254 and 255.
[16] *Ibid.*, Vol. 9, p. 622.
[17] *Ibid.*, Vol. 9, p. 165.
[18] THE CHEMICAL AGE, Vol. 9, p. 120.
[19] *Ibid.*, Vol. 9, p. 95.
[20] *Ibid.*, Vol. 9, p. 488.
[21] *Ibid.*, Vol. 8, p. 421.
[22] *Ibid.*, Vol. 8, p. 210.
[23] THE CHEMICAL AGE, Vol. 8, p. 454.
[24] *Ibid.*, Vol. 9, p. 6.
[25] *Ibid.*, Vol. 8, p. 146.
[26] *Ibid.*, Vol. 9, p. 572.

Chemical Fertilisers in 1923

By Dr. Sidney Williamson

THE conditions of the fertiliser market during the past year have been largely controlled by the general, world-wide depression in agriculture and the extreme variations of the European monetary exchanges. These two forces combined have prevented the fulfilment of the demand for fertilisers which undoubtedly existed, and at the same time hindered its natural expansion.

The past two years have been among the blackest in the history of British agriculture. Unfavourable seasons for the crops were accompanied by high costs of production and low selling prices for the produce, with the result that the farmer made a loss upon nearly all the crops he grew. Naturally perhaps, but certainly mistakenly, he, in too many cases, tried to lower his costs by reducing his fertiliser bill, and the effect was felt throughout the markets. The prospects for the coming year are very uncertain, as unless Government assistance be given to the farmer a large amount of arable land must be laid down, or allowed to fall down, to grass, with a consequent decreased consumption of fertilisers. Yet in spite of the many unfavourable factors in the past it is gratifying to be able to record distinct signs of a growing appreciation of chemical fertilisers by the farming classes throughout the world. Had the necessary capital been available the demand would undoubtedly have been enormous —far greater than in the pre-war period. This increased appreciation is more particularly shown in the case of the nitrogenous fertilisers, nitrate of soda and sulphate of ammonia, and it is not too much to say that, had the conditions been normal, there would have been a pronounced shortage of both.

Nitrate of Soda

During the past nitrate year, July, 1922, to June, 1923, the consumption of nitrate of soda was 2,165,000 tons, compared with 1,528,000 tons in 1921-1922. This figure is undoubtedly smaller than in pre-war years, when the world's consumption approached 2,600,000 tons, but it must not be overlooked that in the earlier period Germany consumed about 800,000 tons, while at present she supplies her demands with synthetic nitrogen products. A most remarkable increase in a country's consumption of nitrate of soda is shown in the case of the United States of America, which in 1922-1923 consumed 984,000 tons, as compared with 550,000 tons in 1921-1922. Undoubtedly this increased consumption was largely assisted by the fact that her agriculturists were so placed financially as to be well able to purchase fertilisers, but it was also partly due to recognition of the fact that by the early use of nitrate of soda the cotton boll-weevil pest could be greatly combated. It is anticipated that the use of nitrate of soda to control this pest will largely increase in the future. The use of nitrate of soda in those European countries which are in a financial position to purchase nitrate of soda is gradually reviving, and in a short time will undoubtedly reach the normal.

With regard to Great Britain, the consumption in 1922-1923 was 81,340 tons, an increase of 15,200 over the year 1921–1922. It has never been possible to determine the exact amount of nitrate of soda consumed for agricultural purposes in this country, as the figures of imports represent the amounts consumed for chemical purposes as well as by agriculture; but the depression in the chemical trade has undoubtedly tended to decrease its commercial use, and the general opinion is that the amount now applied to agricultural purposes is nearly that of the pre-war periods.

The increased consumption of nitrate of soda in the world has been largely helped by the policy of the Chilean Nitrate Association in fixing f.o.b prices for long periods. Their action has tended to control speculation and to give confidence to the importer and merchant.

Sulphate of Ammonia

Great strides have been made during the past year in the production of dry neutral sulphate of ammonia containing 23¾ per cent. of ammonia, as compared with 24½ per cent. in the previous acid quality, it being estimated that at least 70 per cent. of the British production is of the superior quality. The total British production of sulphate of ammonia was approximately 340,000 tons, and about 140,000 tons were consumed in Great Britain and Ireland, while the exports to foreign countries increased by some 70,000 tons.

As in the previous year, the British Sulphate of Ammonia Federation has continued its policy of supplying the British farmer with sulphate at a lower price than could have been obtained for it abroad, a course which has been much appreciated by the consumer and which has led to an increase of 3 per cent. in the British consumption.

The three principal countries, viz., Great Britain, Germany and America, are estimated to have produced something over two million tons; it is impossible to obtain the exact figures, but all the indications of 1922 point to the American total output being in the neighbourhood of 600,000 tons, while Germany is supposed to have produced approximately 300,000 tons of combined nitrogen, although not all of this was in the form of sulphate of ammonia.

As in the case of nitrate of soda, the Continental exchanges have greatly hindered free trading and expansion in the demand for sulphate; in spite, however, of these difficulties the world's consumption has steadily risen, and is some 50 per cent. greater than the pre-war figure.

A large increase must be anticipated in the near future, not only from the greater number and activity of the various coke ovens and gas plants, but also from the synthetic ammonia plants which are being erected in several countries of Europe. It is considered that, when normal world conditions are arrived at, the demand for nitrogenous fertilisers will more than keep pace with the supply.

Synthetic Nitrogenous Fertilisers

The past year's work upon synthetic fertilisers has been of great chemical interest. There has been no great expansion, if any, in the output of synthetic products, although the erection of many new factories has been contemplated. New methods of production have been examined, and most of the European countries are investigating means by which they can produce ammonia or nitrate products, primarily as sources of explosives. The output of combined nitrogen in Germany has been curtailed by the French occupation of the Ruhr, but most of the other countries have made small beginnings. While it is essential that for war purposes nitric acid in some form or other shall be produced, there is greater latitude in the case of fertilisers for agriculture. Hitherto sulphate of ammonia and cyanamide have been the two chief products; cyanamide has not been found entirely satisfactory for agriculture and sulphate of ammonia as a final product has several disadvantages, particularly in the cost of manufacture. Agricultural experiments have therefore been widely carried out to ascertain if chloride of ammonia would prove equal to the sulphate for agricultural purposes. It is too early yet to express a definite opinion, but it is considered that the two forms of ammonia will prove of almost equal value for most crops. Should this be so, it is understood that the manufacture of chloride of ammonia will be comparatively inexpensive, particularly if combined with the Solvay method for the manufacture of soda.

The conversion of ammonia to urea has recently taken place in Germany on a large scale in an endeavour to avoid the use of sulphuric acid for fixing the ammonia. This large-scale production has proved successful, although the production costs are not available. For agricultural purposes, however, urea is not well suited except when combined in mixtures, for when applied as a top-dressing to alkaline soils it tends to decompose, with loss of ammonia. To avoid this disadvantage experiments are being carried out with urea nitrate, but the final results are not yet available.

Nitrate of lime has been produced in the normal quantity, and, while largely consumed in the country of origin, has also been exported in considerable amounts; some 10,000 tons are estimated to have been consumed in Great Britain during the past season.

Synthetic nitrate of soda has not been produced in large amounts, as its manufacture is not economical, but at the same time the synthetic product has found employment in chemical industry, its freedom from chloride of soda making it valuable for certain purposes.

Basic Slag

There has been a steady demand for basic slag and the high-grade qualities were in short supply. Reduced prices certainly tended to an increased consumption, which has been helped also by a fuller recognition on the part of the farmer of the value of slag for the improvement of grassland, and the time does not seem far distant when the demand will overtake the supply. The changed method of steel manufacture has caused many of the slags to be low in phosphoric acid, and accordingly a considerable development has taken place in the use of ground natural phosphates. Tests with these ground phosphates have been carried out at most of the experimental farms in the country, and the results show that they are quite satisfactory if the phosphates have been very finely ground.

Superphosphates

The depression in British agriculture has been particularly felt in the superphosphate trade, and manufacturers have in most cases been selling their produce below cost price. In pre-war years the exports of superphosphate from Great Britain were very heavy, and this large addition to the home consumption enabled the production costs to be kept low. During the last few years, however, the British exports have been negligible, while on the other hand the state of the Continental exchanges has enabled foreign producers to flood the British market with cheap superphosphates.

Potash Manures

Greater interest and understanding has been shown concerning the use of potash fertilisers. During the war there was a great shortage of potash, of which the need was badly felt, especially upon the light land of the country. At the present time potash manures in great variety are obtainable at very reasonable prices from both the French and German mines. The healthy competition between these two sources of supply has led to increased propaganda and advertisement of the merits of potash in agriculture.

The attention of the farmer having been drawn to the beneficial effects of potash in increasing the yield and quality of his crops, the consumption in Great Britain is likely to show a steady increase.

To summarise, then, the past year may be considered generally as one of hope rather than of fulfilment, though signs of a brighter future are apparent. It has been a time of doubt and waiting, but if the agricultural prospects improve there is no question that the fertiliser trade will be among the first of our industries to feel the improvement.

Chemical Trade Movements in 1923

By W.G.W.

DURING the year under review, the chemical industry has moved within narrower limits than was the case during the previous two years, and speaking generally, the result has been that the consumers' confidence has gradually been restored, so that considerably more interest is now being taken in forward business than has been the case for some time past. This is, of course, a very welcome feature and is bound to re-act to the benefit of the trade as a whole.

Business in the early part of the year opened somewhat quietly and buyers operated cautiously, and this state of affairs continued for some few months, orders being naturally for relatively small quantities.

Towards the end of April it became apparent that prices of a number of products produced on the Continent, which had been assisted by declining exchanges, were tending to advance and this enabled English manufacturers again to enter the market with quite a number of articles, more especially perhaps for pharmaceutical products.

In the period from May to August the demand was moderately well maintained, and there were comparatively few fluctuations in prices. It became apparent in September that the demand was steadily broadening, and this expansion was maintained until November, when owing to the action of the German Government in refusing to encash any further Reparation Receipts, the price of a number of products, which had been in the main imported from that country, sharply advanced with a resultant improvement in the demand. This improvement in buying also communicated itself to other products principally made in this country, so that business generally during the closing months can only be described as relatively satisfactory.

Business in heavy chemical products has been in the main fairly satisfactory, and it is significant that English makers have regained their position in several markets which they had temporarily lost, and this is largely attributable to the fact that, wherever possible, they have reduced their prices to the lowest limit.

The continued depreciation of many Continental exchanges has not had the effect on prices generally, as in the previous two years, and most Continental producers and manufacturers have conducted their export business in stable currency. It is significant that to-day prices of some chemicals manufactured in countries with depreciated currencies are well above world parity.

The Fine Chemical Industry is slowly expanding and although trade in the first part of the year was poor, it has since broadened steadily, and during the closing months there have been sharp advances in prices in practically every product.

It is also extremely satisfactory to note that production of fine chemicals in this country continues to expand in a healthy manner.

Export trade has been inclined to be patchy and with some markets trade is extremely difficult. Trade in the early months of the year was poor, and a large proportion of the business passing was placed on the Continent. From about July onwards, however, the demand has increased steadily as prices of the home produced products began to meet those of the foreign, and it is a welcome sign that many of the overseas importers are now placing contracts for successive shipments, whereas for some time their practice has been to indent for only single deliveries. The outlook for export trade is therefore distinctly encouraging.

In conclusion, I may say that I am definitely of the opinion that the outlook as regards the possibilities of export trade is distinctly bright, and with an improvement in trade in the textile and other chemical consuming industries there would be little for the English chemical trade to worry about.

Although financial conditions have been difficult the number of failures have been very small, and were practically confined to unimportant concerns.

A Detailed Review

ACETONE has been somewhat of a fluctuating market. Business opened in January with the product extremely scarce and the price standing at round about £140 per ton, supplies came to hand, however, about the end of January and the price commenced to decline, until at the end of February it stood at £127 per ton at which figure it remained fairly steady until May, when the price again declined to £120. It then again firmed up in August, and the product is now firm at £123 per ton, with an advancing tendency. The volume of trade passing during the year has been only of moderate dimensions and it is significant that the spot price in England is several pounds per ton lower than the figure at which stocks can be replaced from the producing countries.

ACIDS have been generally interesting during the year and with one or two exceptions business has been of great dimensions.

Acetic opened the year at £44 per ton for 80% and continued a steady market at this figure until March, when there was an advance to £46 per ton, the price further hardened to £48 per ton in June, and we close the year with the product firm at £47. Business generally has been of a satisfactory character, and, as will be observed, there have been very few fluctuations in price.

Citric has been an unsatisfactory market with extremely poor demand over most of the year. Business commenced in January at 1s. 9d. per lb. with an easy market, and the price after declining slightly, firmed up so that it reached the price of 1s. 10d. per lb. in May. From that date it has declined by slow stages, and it now stands an easy market at 1s. 5d. per lb.

Formic has been a fairly active market. Business opened at round about £57 per ton for the 85% material, it stood at this figure until April when the value declined to £53 per ton and remained at round about this price until the end of November, when there was a sudden jump to £60 per ton which figure is maintained and the material is now an extremely firm market. This last rise in price was mainly caused by the decision of the German

Government to refuse to honour any further Reparation receipts on business concluded subsequent to the 17th of November. As the majority of supplies have recently been imported from that country a further advance in price is not unlikely if the present state of affairs continues.

Lactic.—This article has been practically stationary in price throughout the year and the volume of material passing into consumption has shown an improvement. The average price has been round about £42 per ton for the 60% by volume material and now shows an advancing tendency, which is to be understood as a considerable quantity of the material has been imported from Germany in the past.

Oxalic.—Demand has been very fair and considering all the conditions trade must be reported as satisfactory. The value in January was 7d. per lb., and it has since slowly fallen and the value is now 5½d. per lb. Nearly all the material sold has been of Continental manufacture.

Salicylic has been a better market during the current year and there have been several sharp fluctuations in value. In January the price was 1s. 5d. per lb. for B.P. and commenced to advance in February and then steadily moved upwards to 2s. 6d. per lb. in March, at which figure considerable business was transacted. The price then began to fall away so that in July it stood at 2s. 3d. per lb., but it has since again risen and the price is now extremely firm at 2s. 6d. per lb. with a prospect of a further advance. The demand for the Technical product during the year has been for only comparatively small quantities.

Tartaric.—Business in this product has only been of moderate dimensions. In January it stood at round about 1s. 3d. per lb., and continued at about that figure until May, when it made a slight advance to 1s. 5d. per lb. Since that date trade has been extremely moderate and the material has declined, and we close the year with an easy market at 1s. 2d. per lb. less the usual 5 per cent.

ALUM has been in moderately satisfactory request throughout the year and has not been so much under the influence of foreign competition, with the exception perhaps of export trade in Potash Alum. At the start of the year the market value was approximately £12 per ton, and this value has continued fairly constant throughout the year, and the market value can be stated at round about £11 10s. per ton delivered to buyers' works.

ALUMINA SULPHATE.—This product has been in pretty constant and satisfactory both in the early part and again at the close of the year. Continental competition has been rather active. 17/18% material was round about £10 10s. per ton at the commencement of the year, after which following the Ruhr occupation it slightly stiffened, declining again slightly in August, and with a further small reduction in value the price can be taken at round about £9 5s., with the 14/15% material standing at £8 5s. per ton.

AMMONIUM SALTS have only been moderately satisfactory, and Continental competition has been in evidence, although during the latter part of the year the English manufacturers are again able to report better business.

Carbonate has been in moderate request despite severe Continental competition at times, the English manufacturers, however, have been able to hold their own, and we close the year with a fair business to report with the product standing at 3d. to 3¼d. per lb.

Chloride has been largely under the influence of Continental competition during most of the year, business was done for the Fine White Crystals in January at £30 per ton, and continued round about this figure until in June the value was £27 per ton. The price steadily advanced in November under the influence of the German Reparation position and supplies are now difficult to obtain at £32 per ton. The forward position is extremely uncertain.

Phosphate.—This article has been fairly steady and although slightly on the decline the English makers have now been able to practically take care of most of the English trade, and from £65 per ton in January the market has slowly declined to about £55 per ton, at which figure it is to-day a firm market.

ARSENIC.—This material has been as usual a pretty fluctuating market and at times the demand has been in excess of the supply, especially for near delivery. The American demand especially in the spring and summer months was exceptionally heavy, and after a somewhat quieter period the demand has again become more active as this report is written. In January the price for White Powdered was round about £73 per ton at which figure it remained more or less steady until about July when a slight decline set in, and the price by November had declined to about £63 per ton, with little material offering for near delivery.

BARIUM SALTS have, on the whole, been fairly satisfactory.

Chloride opened the year with the material well held at £18 per ton and continued fairly steady until March, when the price started to decline, until in June the material could be obtained at £15 per ton. It has remained fairly steady at round about this figure, and the closing value may be taken at £14 15s. per ton, with quite a satisfactory demand.

Nitrate.—The demand for this article over most of the year has been extremely poor, and what business there has been has mainly been taken by Continental producers. The market in January was round about £32 per ton, and continued fairly satisfactory until October, and since that date there has been a slight advance, and to-day it stands at about £25 per ton, with the material fairly scarce and inclined to advance.

BLEACHING POWDER has been a fairly satisfactory market, especially on home trade account, during the year, and the figure for the English product has remained steady at £10 10s. per ton for bulk deliveries, while for next year the price is £10 per ton. In regard to the export trade this has been somewhat fluctuating, although it is significant that the American competition has only been felt to a small degree. In the early months of the year the German quotations were substantially lower than the English, but these did not operate very long, and to a large extent to-day the English makers are able to hold their own with the Continental producers.

COPPER SULPHATE.—This product has again this year proved distinctly uninteresting and unsatisfactory from the English producer's point of view, and has practically throughout the year remained under the influence of Continental competition. In January the market was standing at approximately £27 per ton, and continued at this figure with little demand until July, when the value had fallen to about £26 10s. per ton for the English product. The market closes easy at £25 per ton, but both the German and the Belgian product can be obtained at under this price. Signs are not wanting, however, that the Continental producers are becoming filled with orders, and, therefore, there seems a probability that the market for English manufacture may revive to some extent at an early date.

CREAM OF TARTAR has only been in poor request throughout out most of the year, and price levels have been extremely low. It is becoming increasing evident that one or two markets in which this article was formerly used and which owing to the extremely high prices were lost during the war are not easily being recovered, and the future outlook would appear to be extremely uncertain. In January the 98/100 per cent. material could be obtained at £100 per ton, after which date it slowly declined, until in June the market value was round about £94 per ton. The high strength can now be obtained at £83 per ton, and at this price the market appears to be a little steadier than has been the case for some time past.

EPSOM SALTS have been in moderately active request throughout the year and from about £5 per ton in January the market has remained fairly steady on home trade account, and to-day the material stands at £4 10s. per ton. Naturally, very little German material has found its way into the country, but, on the other hand, only a very small amount of English technical quality has been exported, the majority of this trade still being in the hands of the German producers.

FORMALDEHYDE.—This has been an interesting article, and the price has fluctuated a good deal. At the opening of the year the material was in extremely short supply at £80 per ton, and then sharply advanced to about £90 per ton in March, at which figure it stood fairly level until May, when a further upward movement took place in common with most other wood distillation products. In July, owing to the uncertainty of the position prevailing, the price for spot material further advanced to £100 per ton, pending the decision of the referee as to the liability of this product under the Safeguarding of Industries Act. This decision was made known at the end of August, and the result began to manifest itself at the end of September, when the price suddenly declined to £70 per ton, and we close the year with a firm market at £65 per ton.

IRON SULPHATE has been a much more satisfactory market, and very considerable quantities have been exported. Germany and Scandinavia in particular having taken considerable quantities, the average value to-day is round about £3 per ton to £3 10s. per ton in barrels, with the material in short supply.

LEAD SALTS have not moved to any large extent, but business has in the main been fairly steady, and towards the latter part of the year prices have hardened.

Acetate.—This article, as was the case last year, has been mainly under the influence of German competition, but the volume of business has been fairly satisfactory. The market opened at round about £39 per ton, at which figure it has been fairly steady until about October, when it started to harden, and to-day the material is extremely firm at £44 per ton, at which figure it is now possible for home trade producers to again compete.

Nitrate.—Business in this product has been of extremely small dimensions, although the price has been remarkably steady throughout the year at between £42 and £44 per ton, at which latter figure we close with an improved demand and with a firm market.

LITHOPONE.—This article has also been exceedingly steady in value throughout the year, although the demand has left a good deal to be desired. The value has remained round about £21 per ton.

POTASSIUM SALTS have, on the whole, been in rather poor demand, although in several products recently, mainly owing to the Reparation position, the prices have begun to advance.

Bichromate.—The consumption of this article has been extremely moderate, and the price has moved within very narrow dimensions. In January the value was 6¼d. per lb. and stood at this figure until February, when it was reduced to 5¾d. per lb., at which price the market is maintained. For next year the British makers announce that this price will be less 5 per cent. Foreign competition has been practically non-existent.

Carbonate.—Business in this product has been of extremely moderate dimensions during the year, and the price has moved within narrow limits. In January the material was standing at round about £24 per ton, on the basis of 80 per cent., and it stood at this figure with little variation until April, when an advance was registered to £27 per ton. This price was maintained until October, when there was a slight decline to £26 10s. per ton. As we close, however, the product is much firmer at £28 per ton, with the prospect of a further advance.

Caustic.—This also has been a product in short demand, and moving within narrow price limits, and it may be said that generally the market has been in buyer's favour. In January the market was round about £31 per ton for the 88/90 per cent. material, and this moved slightly upwards until in June the price was round about £33 per ton. Since that date the price has been fairly steady, and we close with an extremely firm market at £32 per ton, with prospects of a further advance.

Chloride has been largely uninteresting. At the commencement of the year the ordinary commercial product was standing at about £15 per ton, and has declined slowly to the present figure of £9 10s. per ton, at which figure little business is reported.

Permanganate has, as usual, been a fairly interesting product, although the volume of demand, especially during the earlier months of the year, left a good deal to be desired. With the advancing price, however, business seems to have been stimulated, and of late the consumption has shown a tendency to increase. In January the market stood at 8½d. per lb., with the material in small request, and by March it had advanced to round about 9½d. per lb., with a better market. This figure was advanced to round about 10d. per lb. in May, at which price the product has remained fairly steady until the end of this year, and we close with a firm market, and with the prospects of a further advance.

SODIUM PRODUCTS have been generally fairly active throughout the year, with one or two exceptions, and it may be noted that the demand for English materials is still maintained, and that for the heavier products foreign competition is negligible.

Acetate.—This product has, relatively speaking, varied very little while the demand has on the whole been satisfactory, considering existing conditions. In January the value for prime white crystals was £24 per ton, and towards the middle of the year this declined to £22 per ton. A recovery has taken place, however, and the market closes firm at £24 10s. per ton, with the material in short supply. The demand for this product is still being mainly filled by Continental material, but there appears to be a possibility of English makers again being able to enter the field.

Arseniates have, generally speaking, been in fairly poor request, and prices have varied very little. At the commencement of the year the value of the 45 per cent. product was about £47, while in December it was a fairly easy market at £45.

Bicarbonate has varied very little, and has been a steady trade. For mineral water quality the price stands to-day at round about £10 10s. per ton.

Bichromate has been an interesting product. At the commencement of the year the English makers' price stood at 4¾d. per lb., at which figure it easily held the American competition. The American price was then reduced, and the English makers followed suit by reducing their figure to 4½d. per lb. At this price the market stood firm, with few imports, until the close of the year and English makers now announce that for next year's contracts they will allow a discount of 5 per cent. on this figure. A certain amount of material of Russian origin has recently been imported, but although this has been offered at a slightly reduced figure it is not disturbing the market to any degree. The export trade in the English article has also increased during the period under review.

Bisulphite.—This product has been in good request throughout the year, and the English makers have easily been able to hold their own against the foreign competition. Prices have varied little, and the demand has been steady. Commencing the year at round about £20 per ton, according to package, the price has been reduced, until to-day it stands at £18 10s. per ton, with good business passing, and Continental quotations on the whole higher.

Chlorate.—This has been a very poor market, and prices have varied very little, while business has been mainly done in the imported products. In January the market was round about 3d. per lb., and it is quoted on contract terms to-day at 2½d. per lb., at which figure it may not be said to be overvalued.

Caustic has been a fairly satisfactory product throughout the year, although on export markets there was a considerable amount of American competition during the first half of the year. This has now declined appreciably, and English makers are rapidly recovering several of the lost markets. For home trade the price in January was round about £20 per ton for 70/72 per cent., and is to-day £17 17s. 6d. per ton.

Hyposulphite.—English makers report a very much better trade this year, and foreign competition has been eliminated to a large degree, while a pleasing feature has been that export orders for British makes have largely exceeded those of last year. Commercial was quoted at £10 10s. per ton in January, and has remained constant at this figure throughout the year. As regards the photographic quality, trade has been fairly heavy, both on home and export account, and the price has been relatively steady during the year at £15 per ton.

Nitrite.—Trade generally in this article has been poor, except during the closing months of the year. The demand, in the main, has been for small quantities for spot delivery. In January the material was firm at £29 per ton, and then declined by successive degrees to £25 10s. per ton. In November, however, mainly owing to the European situation, the price suddenly commenced to rise, with the resultant increase in the demand. We close with an extremely firm market at £29 per ton, with prospects of the price going still higher.

Phosphate has only been in moderate demand during the year, and from £15 10s. per ton in January it has declined to the present figure of about £14 per ton, or slightly less, according to locality.

Prussiate has been an unsatisfactory market, and the demand experienced generally this year has been poor in the extreme. In January the price was firm at 10d. per lb., and this figure was maintained until April, when the price eased off to 8½d. per lb., increased supplies of British make being then available. By June the price had further declined to 7d. per lb., and with the abnormally slow demand the value continued to droop, and owing to pressure of Continental competition was offered at 5¾d. per lb. in October. The market closes somewhat steadier, but with the demand still extremely poor at 5¼d. per lb., at which figure the product certainly appears to be cheap.

Sulphide.—Business in this product has been moderate during most of the year, although the price has firmed up towards the close, and there is now a distinct improvement in the export demand. In the early months British manufacture was entirely unable to cope with the Continental competition, but this is now very little in evidence. The market opened at £17 per ton for solid, and £10 10s. per ton for crystals; this price was maintained until May, when the price declined to £15 10s. for the concentrated and £10 per ton for the crystals. A further reduction took place in August to £15 and £9 per ton respectively, and the article is now extremely firm at these figures.

Sulphite.—This material has been practically stationary throughout the year at round about £11 per ton for commercial and £17 per ton for the photographic quality. Business generally has been of moderate dimensions only.

TIN SALTS have been more active, and a fair amount of business has been transacted.

ZINC CHLORIDE.—The price of this product has moved within narrow limit during the current year, and to-day's value of the solid material is round about £28 per ton.

ZINC SULPHATE has been in much better request, and from an opening value of about £16 per ton the figure declined to about £13 per ton, but in October the market firmed up, and we close with the quotation strong at £15 10s. per ton.

Electro-Magnetic Treatment of Steels

IN a paper read by Mr. Lancelot Wild, M.I.E.E., before the Institution of Production Engineers, the author stated that in the heat-treatment of steel it was not only important to know the temperature of the steel, but also the time it had been maintained at that temperature. Steel containing not more than 0·4 per cent. of carbon could be hardened perfectly by quenching it at 750° C. if it had been heated slowly, while to obtain similar results with rapid heating a temperature of 810° C. might be reached. The point was that the steel should be heated until its magnetic properties disappeared. This had been shown by Roberts-Austen in 1897 and had never been seriously disputed, but it was not until 1916 that a practical application of the electro-magnetic system of heat treatment was made. The author stated that so far as he was aware the only furnace on the market with electro-magnetic equipment was the Wild-Barfield, manufactured in England by Automatic and Electric Furnaces, Ltd. It was shown as the result of experiments that the electro-magnetic method was applicable, with slight modifications, to a wide range of alloy steels.

Chemical and Allied Societies

Notes on Their Work During 1923

Association of British Chemical Manufacturers

An important part in the activities of the Association of British Chemical Manufacturers during the past year has been directed to keeping the general public, both in this country and abroad, informed as to the progress of British Chemical Industry, and emphasising the great part it is playing in the industrial life of this country. As was the case last year the Association organised the Chemical Section of the British Industries Fair held at the White City. This section was the largest and most imposing exhibition which had ever been held in this country in connection with chemical manufacture. Moreover, it contained a new feature in the form of a sub-section devoted to chemical plant which attracted much attention.

As our readers are doubtless aware, the Association has also been very active throughout the year in organising the Chemical Section of the British Empire Exhibition to be held at Wembley next year. This section, which is expected to be one of the most important in the whole Exhibition, is designed to present a complete picture of the present state of British Chemical Industry, and in it all the leading chemical manufacturers in the country will be represented. In addition to trade exhibits, a Scientific Section will show that Britain is not only maintaining her position, but is in the forefront of scientific research.

Advantage has been taken of modern methods of educational propaganda, and our readers will no doubt remember Mr. Woolcock's address on the importance of chemical industry to national life which was broadcast on the 19th September, 1923.

The cinematograph is also being made use of, and two films dealing with the heavy chemical industry and coal tar products respectively are practically completed, and will be on exhibition very shortly.

The Council of the Association has followed closely the working of the Safeguarding of Industries Act, and has received frequent reports from the Group more especially affected by it. The policy laid down during the previous year of allowing the Group concerned to deal with questions arising out of the administration of the Act has been maintained. From the reports received the Council notes with great pleasure a diminution of the number of complaints of the delay in the passage through the Customs of chemicals included in the Schedule to the Act, and a steady progress in the continuous development of the manufacture of British Fine Chemicals. In quality, as well as in quantity, a most gratifying advance has been made.

The Dyestuffs Act has now been in operation for three years. The representatives of the Association have attended over seventy meetings of the Licensing Committee, and some fifteen meetings of the Development Committee. A report of the latter committee is to be presented to the Government. In addition to these formal meetings a large number of informal conferences have taken place in London and Manchester, and it may be said that the work has gone on continuously throughout the year. In the opinion of the Council the result achieved by the Group has been worth the work entailed. It is only necessary to state that the position of 1913 has been exactly reversed. In that year we imported 80 per cent. of the dyestuffs required in this country and made 20 per cent. here; in 1922 we made 80 per cent. and imported only 20 per cent.

The subject of Industrial Alcohol has received the constant attention of the Council throughout the year, and prolonged negotiations have taken place with H.M. Board of Customs and Excise with regard to extended facilities for the use of duty-free alcohol in chemical manufacture. A much better relationship has been established between the Customs authorities and the manufacturers as a result of these conferences.

Parliamentary matters in so far as they affect chemical industry have been closely followed by the Council. Mention might be made of the Salmon and Freshwater Fisheries Bill and the Oakham Gas and Electricity Bill, in which a number of amendments were secured in order that they should not be detrimental to the interests of chemical manufacturers. The Smoke Abatement Bill and the Petroleum Bill have also received close attention as matters affecting the industry.

The use of preservatives and colouring matters in food is a question of considerable interest to chemical manufacturers, and the Association is giving evidence before the committee appointed by the Minister of Health to report on this matter.

The Council has extended its sympathy to the proposed establishment of a Chair of Engineering at University College, London. Among other matters questions relating to the terms of contracts with local authorities, patent laws and trade marks, etc., have also been considered.

Transport

The Association has been actively engaged in watching the developments in connection with matters arising out of the Railways Act, 1921. It has taken a prominent part in the negotiations leading up to the general reductions in railway rates in August last. Other matters which have either been settled or under negotiation are conditions of carriage, retention of exceptional rates, standard revenue and schedules of standard charges. A great step forward has been made in the relations between the railway companies and the traders, and a large measure of the success that has been attained is due to negotiations that have taken place during the past year.

The Association has continued its close co-operation with various affiliated Associations among which may be mentioned the Association of Tar Distillers, the British Disinfectant Manufacturers' Association, and the British Chemical Plant Manufacturers' Association. With regard to the last named a Joint Research Committee has considered problems of interest to both makers and users of chemical plant and in the early part of the year issued a standard specification of cast iron filter presses which has since been adopted as a British standard by the British Engineering Standards Association. In conjunction with the Association of Tar Distillers, negotiations were opened up with the Ministry of Transport in connection with the new specification for road tar, which was subsequently modified in accordance with suggestions put forward by the Association.

Continental Situation

The situation on the Continent created by the occupation of the Ruhr by the French has been carefully watched by the Council. Its effect on British chemical industry has been momentarily to give an added impulse to the general recovery which has been in progress; its ultimate effect on the world's trade is impossible to forecast. The seizure of stocks of German chemicals, notably dyestuffs, and their transference to France is, however, of vital importance to British chemical industry. No efforts have been spared to bring home to the various Government Departments concerned the importance of this subject to British chemical industry and the harm which might be done by the indiscriminate disposal of these stocks.

G. J. A.

British Association of Chemists

The outstanding feature of the work of the British Association of Chemists during the past year has undoubtedly been the working of the Unemployment Benefit Fund. Although it will hardly be possible to pass full judgment upon the scheme for some time to come, the first year's working indicates that the scheme is financially sound. Including advance subscriptions, approximately £1,900 has been paid into the fund and benefits disbursed amount to £826 2s. 6d. The creation of the Special Reserve Fund provided for in the Rules has recently been considered.

The Legal Aid Department of the Association has once more proved of great value to members during the past year, and advice given in a number of cases relating to agreements, etc. This is one of the distinctive features of the Association's work, as the Association is able, if necessary, to give full support to its members in cases involving actions-at-law.

The past year has afforded several opportunities for the Association to bring its activities before the notice of members

of Parliament. At the last two Parliamentary elections, questionnaires based on the political programme of the Association were circulated to candidates, and the interests of the Association in the matter of the Pharmacy Acts (Amendment) Bill and the Bill for the regulation of the sale, manufacture, and importation of therapeutic substances have been carefully watched in the House of Commons by Mr. C. S. Garland. Representations in the interests of members were made to the Gas Therm Charges Committee in connection with the qualifications for examiners under the Sales of Gas Act. The Association was not required to give evidence before the Committee, but the Statement was ordered to be annexed to the official proceedings.

Negotiations with the National Union of Scientific Workers have been in progress thoughout the year, but the proposals for the leasing of joint or adjacent offices have not materialised. A scheme for the issue of a joint journal has been drafted and approved by both executives, and it is hoped that the joint journal will be issued early in 1924. Arrangements have been made for the financing and development of joint activities as opportunity arises, while ample provision has been made to ensure the maintenance of the separate identities of the two Associations, however close co-operation may become in the future.

In spite of the inevitable restrictions imposed on its activities by the continued depression in trade, a survey of the work of the British Association of Chemists during 1923 affords much evidence of the vitality of the Association. Of this vitality and of the growing appreciation of the work which the Association has done and is doing for all classes of chemists there have been no surer signs than the success of the annual meeting at Birmingham, and the interest evinced by the conference of the Institute of Chemistry at Liverpool.

R. B.

British Chemical and Dyestuffs Traders' Association

THE Association was formed on May 1 last as the outcome of a fusion between the two old Associations. The benefit to traders of having one thoroughly representative organisation to voice their views and protect their interests is amply demonstrated by the successful work already performed.

In connection with the importation of dyestuffs the Association has gained several practical concessions for its members, and for some time past has been issuing lists of reparation colours as they arrive in this country.

The work of protecting members' interests in connection with the Safeguarding of Industries Act has been continuous, and in many directions the trade generally has benefited as a result of the Association's activities.

A feature of this organisation's work during the period under review has been the constant activity and vigilance in matters connected with trade with the occupied territories of Germany, and it can be stated that without the Association's assistance traders would have found it almost impossible to have surmounted the many difficulties and obstacles that have confronted them of late.

During the past eight months fourteen new members have been elected. About 3,000 copies of bulletins and circulars have been forwarded to members. The Executive Council have held regular meetings and have recently completed the Memorandum and Articles of Association for Registration. For the coming twelve months a full programme has already been mapped out, and will include, amongst other things, the opening of branches in provincial centres, such as Manchester, etc.; the standardisation of contract terms; and possibly an effort to organise a chemical exchange for London.

British Engineering Standards Association

BRITISH Standard Specifications for silicon iron and for iron for the manufacture of nitric acid pots and caustic soda fusions are still under consideration. The drawing up of a specification for chemical lead is well on the way to completion, and it is proposed to accompany the specification when issued by a standard method of analysis for chemical lead which is being thoroughly tried out.

The Panel on Gas Cylinders is continuing its work and attention is being given to the laying down of standard dimensions for the screw threads on valve stems and outlets, with a view to their making a satisfactory fit in the necks of existing cylinders and with union nuts in general use.

A British Standard Specification has been issued for cast iron and enamelled cast iron steam-jacketed pans and a British Standard Specification for filter press plates and frames is about to be issued.

Chemical Engineering Group

THE Chemical Engineering Group of the Society of Chemical Industry has every reason to congratulate itself upon its strong position at the end of 1923, following a period of two or more years of depression, owing to the phenomenal trade slump. The membership of the Group, which had temporarily fallen off in consequence of the difficult industrial conditions, has shown a welcome revival, and the Group is now as well supported by its members as at any period in its existence. The relationship between the Group and the Parent Society has been developed in the year under review, in the direction of a closer working of the two bodies with a view to more efficient and economical administration, and efforts in this direction are still being made, to the mutual advantage of everybody concerned. The ordinary scientific activities of the Group have been maintained at the same high level as before.

The issue of Data Sheets has not progressed as much as had been anticipated, largely owing to an initial lack of funds, which difficulty has been temporarily removed by the grant to the Group by the Parent Society of a sum of money from the Messel Funds under its administration. The Sheets issued during the year comprise :—

5. *Properties of Carbonic Acid.* (Curves exhibiting various properties of carbon dioxide and the mutual relationship of certain pairs of the variables :—Solubility in Water, Vapour Pressure, Total Heat, Latent Heat, etc.)

5a. *Properties of Carbonic Acid.* (Letterpress sheet additional to, and explanatory of, Sheet No. 5.) (Sheets 5 and 5a supplied together for 1s. 6d. the pair, post free.)

6. *Properties of Tan Extract Liquors.*(Curve showing the relationship between the percentage solids and the specific gravity, expressed in three scales, of tan liquors.)

7. *Properties of Hydrochloric Acid.* (Curve exhibiting many results of Dr. Hurter's classical researches.

7a. *Checking Points and Explanatory Sheet for Data Sheet* 7. (The two Sheets 7 and 7a are sold together, 1s. 6d. the two, post free.)

8. *Air-Drying Data.* I. Cubic feet of air required to remove 1 lb. moisture.

9. *Air-Drying Data.* II. Volume at exit of 1,000 cubic feet entering at 15° C.

9a. *Air-Drying Data.* III. Explanatory sheet for Nos. 8 and 9.

Quite a number of others are almost ready for printing.

The Group has developed during the year the practice (recently inaugurated) of holding meetings at more frequent intervals in London, at which a number of important subjects have been treated. Amongst these are to be noted discussions on—"Some Control Equations in the Process of Leaching and Evaporating," by Professor F. G. Donnan, F.R.S.; "Heat Transmission in Coolers, Heaters and Condensers," by Mr. Basil Heastie, Assoc.M.Inst.C.E. In addition to these, very important meetings have been arranged in the provinces, and the following have already taken place :—Joint Meeting of the Hull Chemical Engineering Society and the Chemical Engineering Group: paper by Mr. J. Arthur Reavell, M.I.Chem.E., M.I.M.E., on "Extracts of Tan Liquors." The programme of the Group for the year 1924 is an extremely interesting one.

The Group has recently issued Volumes III and IV of its Proceedings, which contain some extremely interesting and important papers, notably one on "Ammonia Stills," by Mr. P. Parrish, A.I.C., read at the July, 1922, Conference in Glasgow. The Group continues to make substantial progress, and is fast making a name and reputation for itself as a body of up-to-date and energetic scientific societies.

One of the most important activities in the hands of the Group for the year 1924 is the arrangement of the Chemistry and Physics Section of the important World Power Conference to be held at Wembley during June and July of that year. Every scientific society of importance throughout the civilised

world, dealing with the production and utilisation of power, is co-operating in this Conference, and the printed articles of the proceedings should form a volume of unrivalled interest and unique importance. H. T.

The Chemical Industry Club

ALTHOUGH the Chemical Industry Club, like other stable organisations, has had to pursue a conservative policy during the long period of depression, it looks forward to the return of more cheerful times when, doubtless, a considerable number of chemists will knock at its portals for admission. On the financial side, the Club has always made ends meet. Socially the Club has made good progress, and it is satisfactory to record that of late members have attended in increasing numbers. The monthly meetings of the past year provided some excellent addresses both by members, including Dr. T. R. Duggan, of New York and Dr. W. R. Ormandy, and by distinguished guests, like Mr. H. L. Sulman, who gave a most interesting account of "Froth Flotation." The past year has also been noteworthy for the retirement from office of the original hon. secretary and hon. treasurer, both of whom well deserve the encomiums which have been bestowed upon them. Their successors, though feeling the weight of pre-established efficiency, are striving cheerfully to emulate the deeds of their predecessors.

The future of the Club appears to be assured, and as time progresses it is hoped that its already large membership will be strengthened by the influx of more representatives of the academic as well as of the industrial sections of the chemical community. The hope may also be expressed that within measurable time the Club will possess a home of its own, situated within easy reach of that Chemical Vatican which at present lies obscured in the mists of pious aspiration.

J. ARTHUR WILLIAMS.

The Chemical Society

THE Chemical Society was founded in 1841, and received its Royal Charter in 1848. The object of the Society, as laid down in the charter, is the general advancement of chemical science by the discussion and publication of new discoveries, and the interchange of valuable information respecting them. Under the terms of the supplemental charter granted in 1920, the membership consists of fellows and honorary fellows. Fellowship is open to members of either sex. Every candidate for election as a fellow must be proposed according to a form of recommendation subscribed by not less than three fellows of the Society to whom he is personally known. In the case of a candidate resident abroad who is unable to obtain three signatures, the council has the power to accept a certificate signed by one fellow of the Society. The admission fee is £3, and the annual subscription £3. The total membership now exceeds 4,000.

The affairs of the Society are conducted by a council, elected by Fellows from their own body, consisting of the president, not more than twelve vice-presidents, the treasurer, secretaries, and eighteen ordinary members of council.

Ordinary scientific meetings are held, as a rule, twice a month from October to June. At the meetings, papers are read and discussed, and lectures delivered by men eminent in chemistry and the allied sciences. The Society publishes monthly the Journal, consisting of original memoirs communicated to the Society, and Abstracts of papers bearing on chemistry appearing in recent British and foreign journals. The annual reports dealing with the recent progress of chemistry in its various aspects are published in March of each year. The Society possesses a library of some 28,000 volumes, which may be borrowed under certain regulations.

The present officers of the Society are: President, W. P. Wynne, D.Sc., F.R.S.; treasurer, Jocelyn F. Thorpe, C.B.E., D.Sc., F.R.S.; secretaries, James C. Philip, O.B.E., D.Sc., F.R.S., and J. I. O. Masson, M.B.E., D.Sc.; foreign secretary, A. W. Crossley, C.M.G., C.B.E., F.R.S.; assistant secretary, S. E. Carr, F.C.I.S.; librarian, F. W. Clifford.

The Colour Users' Association

THE Colour Users' Association, Cromwell Buildings, Blackfriars Street, Manchester, is an Association formed in February, 1919, to take over, continue and extend the work commenced by the Colour Users' Committee on October 8, 1915. Its principal objects are:—

(1) To watch over, protect and promote the general interests of all users of dyes.

(2) To assist in the promotion and development of the dyemaking industry in this country.

(3) To act as an official body for the representation of all concerned in the use of dyes in all negotiations with the Government or any department thereof or in negotiations which concern the trade as a whole.

(4) To afford facilities for consultation and co-operation and the interchange of views between all concerned in the use and manufacture of dyes.

The activities of the Association during the past year have been concentrated upon the following questions:—

1. Importation of Reparation dyestuffs.
2. Licences under the Dyestuffs (Import Regulation) Act, 1920, and
3. The price of dyestuffs.

The method of requisitioning German dyestuffs as Reparation has been considerably amended as compared with the original terms of the Treaty of Versailles. In order to obtain first-hand information of the current procedure a deputation from the Association visited the official in charge of the Dyestuffs Section of the Reparation Commission in Paris, with beneficial results. Difficulty has been experienced in obtaining supplies of certain dyestuffs owing to the disturbed state of affairs on the Continent, a condition which still exists. Many complaints as to the high prices of Reparation dyes have been successfully dealt with by the Association's representatives on the Pricing Committee.

The work of the Association's representatives on the Dyestuffs Advisory Licensing Committee has been onerous and beset with difficulties, but the compilation by the joint Technical Committee of a list of non-contentious colours and the acceptance and use thereof by the Dyestuffs Advisory Licensing Committee has considerably expedited the granting of licences for such colours, to the general satisfaction of users.

Applications for licences on the grounds of price difference are more difficult to deal with, but much delay can be avoided by users strictly adhering to the procedure suggested in the "Vade Mecum," 1923-24, issued by the Association in October, 1923.

Negotiations have been proceeding throughout the year with regard to the high prices of dyewares. The Dyestuffs Advisory Licensing Committee is at present prepared to grant licences for foreign colours in cases where the British makers are unwilling to accept a maximum of three times pre-war price for their counter-products, and the Association is pressing for the application of this principle in pricing Reparation dyestuffs.

The Vigilance Committee has continued its activities with regard to the wrongful inclusion of certain chemicals in the dutiable schedule laid down under the provisions of the Safeguarding of Industries Act, and many chemicals of importance to the colour using industries have been removed therefrom.

A "Vade Mecum" for 1923-24, containing a fund of useful information, was issued in October.

The officers of the Association are:—President, Mr. Henry Allen; Chairman, Mr. H. Sutcliffe Smith; Hon. Treasurer, Mr. J. R. Denison; Hon. Technical Adviser, Mr. G. E. Holden, M.Sc., F.I.C.; Secretary, Mr. Ellis Green, F.C.A. E. G.

The Faraday Society

THE Society has had an unusually busy year. It held seven ordinary meetings and in addition four general discussions. The general discussion held on April 13 took place at Sheffield, jointly with the Sheffield Section of the Institute of Metals and the Manchester Metallurgical Society, and the subject considered was "Alloys Resistant to Corrosion." These alloys included a non-tarnishable silver which was described and exhibited for the first time and the well-known non-corrodible steels which have not up to the present been the subject of much scientific consideration.

On May 28 a general discussion was held on "The Physical Chemistry of the Photographic Process," to which Professor W. D. Bancroft contributed an introductory address and to which in addition 27 other papers were contributed. Features

of the discussion were the important contributions made by Dr. Slater Price and his colleagues of the British Photographic Research Association, and among foreign contributors were Professors Luther and Goldberg of Dresden, Dr. Lüppo-Cramer, Monsieur Clerc of Paris, Messrs. Lumière and Seyewetz of Lyons and Professor Plotnikow of Agram. Several valuable communications were also received from the Eastman Kodak Laboratory as well as from the research laboratories of the leading English manufacturers of photographic materials.

A general discussion on July 13 was held at Cambridge to discuss "The Electronic Theory of Valency." This proved to be a meeting of exceptional interest and it was attended by the leading authorities on the subject both on the chemical and physical sides.

On November 26 a general discussion was held on "Electrode Reactions and Equilibria." Among those who took part in the disoussion were Professor Biilmann of Copenhagen and Dr. Heyrovsky of Prague.

On December 17 the meeting was devoted to the reception and discussion of a Report by Mr. W. H. J. Vernon on "Atmospheric Corrosion," communicated by the British Non-Ferrous Metals Research Association.

The numerous miscellaneous papers presented to the Society dealt principally with colloids, the properties of the various states of matter and metallography.

Reports of the general discussions are included in the *Transactions* of the Society. They are also published separately for the benefit of non-members interested in any particular subject.

The programme for 1924 will include general discussions on "Fluxes and Slags used in Metal Melting and Working" (to be held jointly with the Institute of Metals), "Physico-Chemical Problems relating to Textile Fibres" (which may be held at the British Empire Exhibition at Wembley), and "The Physical Chemistry of Rock Formation," which it is intended to hold jointly with the Geological Society and the Mineralogical Society. Some of these discussions may be continued at provincial centres in conjunction with the local sections of the Society of Chemical Industry.

The present President, Sir Robert Robertson, K.B.E., F.R.S., remains in office until October, 1924. The Secretary and Editor to the Society is Mr. F. S. Spiers, O.B.E., and particulars of the Society may be obtained from him at 10, Essex Street, London, W.C.2. F. S. S.

Federal Council for Pure and Applied Chemistry

DURING the year 1923 the Federal Council has been energetic in acting as the British organisation of the International Union of Pure and Applied Chemistry. It raised a fund for the purposes of the meeting at Cambridge, and after paying the expenses of the meeting has now a nucleus of nearly £1,000, which will be of great value in the future. The meeting at Cambridge was a conspicuous success and the scientific discussions were important. A larger proportion of the meeting was devoted to science and a smaller proportion to the organisation and committee work than hitherto.

The preparation of the International Table of Atomic Weights and the vexed question of the suitable name for the element whose atomic number is 72 have received attention. We understand that the new table of atomic weights will shortly be published.

The meetings of the Federal Council and some other Councils have contributed to an increased knowledge of the value of co-operation, and this has had valuable results. S.M.

The Institute of Chemistry

THE Institute is again able to record a year of progress and activity. The number of entries for the examination has shown a further marked advance, and the roll of membership has been increased by over 300.

The Sections which were formed in the principal centres throughout the country a few years ago have become more thoroughly established and have taken a live interest in all matters affecting the profession. Many of them have held meetings and functions jointly with the Local Sections of the Society of Chemical Industry and other scientific bodies.

On the invitation of the Liverpool and North-Western Section, a Conference of the Institute was held at Liverpool in October, when many matters of interest to chemists were discussed. The Report of the Conference will be published at the end of the year.

The Students' Association, which is specially connected with the London and South-Eastern Counties Section, has fulfilled a very useful programme, including many visits to works.

Besides the ordinary business of the Institute, among the subjects to which the Council have given special attention are the following:—Gas examiners; Indian Ordnance Department; bacteriological tests of milk; Patent Office procedure; laboratory requisites; Income Tax; conditions of appointments of public analysts and of official agricultural analysts, other official chemists and teachers of chemistry.

The co-operation of the Institute with the Board of Education in the scheme of training and examinations for National Certificates in Chemistry has been extended to the Scottish Board of Education

The Institute co-operated with the Chemical Society and the Society of Chemical Industry in a Chemists' Dinner, held at the end of October, and held an official public dinner, reported in these columns in the issue for December 15 (page 654), which clearly illustrated the increasing influence of chemistry in the affairs of the country.

Institution of Petroleum Technologists

DURING the year the following papers have been read before the members of the Institution:—January 9.—"Further Investigations into the Physico-Chemical Significance of Flash-Point Temperatures," by Dr. W. R. Ormandy and E. C. Craven. February 13.—"Some Practical Notes on Oil Pumping," by G. W. E. Gibson. March 13.—Presidential Valedictory Address, "Fire Hazards and Fire Extinction," by Professor J. S. S. Brame. April 10.—"Potrero No. 4. A History of one of Mexico's Earliest and Largest Wells," by E. Chambers. May 8.—"Heavy-grade Egyptian Crude Petroleum," by W. A. Guthrie. October 9.—"Recent Research bearing upon the Origin of Petroleum," by E. H. Cunningham Craig. November 13.—"Galician-Canadian Pole Tool Fishing Methods," by Albert Millar. December 11.—"Rotary Drilling," by L. R. McCollom.

The membership during the year has increased from 561 to about 670. The premises of the Institution were changed from 5, John Street, Adelphi, to more commodious premises at Aldine House, Bedford Street, Strand. The Institution is represented on the following Committees:—Mining and Metallurgical Congress to be held at the British Empire Exhibition, 1924. Scientific Committee of the British Empire Exhibition, 1924. Various sub-Committees of the British Engineering Standards Association, dealing with petroleum and petroleum products and others. During the year a Committee of the Institution, together with representatives of the Admiralty, War Office, Air Force, Board of Trade, and the leading oil companies, have been considering the standardisation of the testing of petroleum and petroleum products, and their results will be published early in the New Year.

In June, 1923, the Institution was represented at the Sixth International Mining Exhibition held at the Royal Agricultural Hall, and organised a petroleum conference, where the following papers were read and discussed:—"The Riddle of the Carpathians" (Opening Address), by E. H. Cunningham Craig. "Oil Deposits and the Tectonics of Vertical Pressure," by Dr. Maxmillian Kraus. "Note on the Genesis of Hydrocarbons and their Localisation in certain zones of the Earth's crust," by R. d'Andrimont. "Oilfield Waste," by A. Beeby Thompson. "The Mode of Appearance of the Petroleum Deposits in the Carpathian Region, with general consideration on the Genesis of the Petroleum and the source of the actual deposits," by Professor J. Voitesti (Cluj University). "An Economic Study of Petroleum Mining by Underground Drainage," by Major J. A. Lautier. "The Standardisation Movement in America and its relation to and Application towards the Elimination of Waste in the Petroleum Industry," by C. A. Young and S. D. Tuthill. "The Caribbean Oil Region," by George Howell.

The Institution was also represented at the Troiséme Congrés de Chimie Industrielle held in Paris, October 21-26, 1923,

and at the International Petroleum Exposition and Congress held at Tulsa, Oklahoma, U.S.A., October 8 to 14, 1923. During this year the Journal has been issued in six two-monthly parts instead of quarterly as before.

National Association of Industrial Chemists

THIS Association continues to work quietly and steadily in the interests of its members and others engaged as chemists in various branches of industry. During the past year it has been chiefly concerned with the younger men, whose positions have been, in many cases, critical, because of the very extensive lack of employment. So serious has this been that many promising young chemists have had, temporarily at least, to abandon chemistry and take up other work which offers more immediate remuneration.

So much attention has necessarily been devoted to the securing of employment and to safeguarding the interests of chemists who would, otherwise, have been thrown out of work, that it has not been possible to devote much time to other matters. The importance of these is fully recognised and they are receiving due attention consistent with the more urgent needs of the members in other directions.

As members who are out of work are relieved of the necessity of paying subscriptions, the burden of carrying on the work of the Association is thrown on the remaining members, whose unselfishness and altruism deserve much praise. A. B. S.

The Oil and Colour Chemists' Association

DURING the past year the activities of the Association have been numerous and varied.

Although the efforts to form a Paint and Varnish Institute, which should become an authoritative body representative of the scientific and technical interests of the industry, have proved abortive, the need of more intensive application of science to the industry on the one hand, and on the other a greater intimacy of the scientist with the industrial conditions, has been more fully appreciated.

It has been the object of the Association to promote this co-operation, and its publications during the year represent fairly accurately the extent to which it has attained its objects. The contributions received during the year were much greater than any received during the preceding year, and the prospects such that the Council felt justified in attempting a long-cherished scheme for making the Journal a regular monthly publication with abstracts, articles and advertisements, which would appeal to the technical workers in the industry. This scheme will officially come into operation in the New Year.

In reviewing the work of the Association during the past year it is of interest to notice the extent to which certain definite problems have occupied the attention of members.

The question of specifications naturally has been prominent, since several of the members have served on the various Committees of the British Engineering Standards Association concerned with the plant, raw materials and products of the oil and colour trade.

A paper by W. Bayley Parker (Vol. 5, No. 33) on "Specifications for Gum Resins and Shellac," provoked a long and vigorous discussion, in which our American friends participated with characteristic enthusiasm.

A recent paper by Dr. J. J. Fox (Vol. 6, No. 41) on the "Government Standard Test of Lead Compounds" is at present in course of publication. As to the actual work of the Committees reference may be made to Dr. H. H. Morgan's Report (Vol. 5, No. 40).

The interest in the physical properties of paint and varnish shews no signs of abating, and a paper by A. de Waale (Vol. 6, No. 38) on "Viscometry and Plastometry," opened up a field of work, which, so far, has not attracted much practical attention in England, though the work of Bingham and his collaborators in America has been watched with great interest. In the discussion which followed these gentlemen took part, and though there proved to be many points on which workers disagreed, it is apparent that, given time and experimental data, the exact study of the physical properties of paint and similar mixtures will not only greatly increase the ability of the chemist to control and standardise products, but also add greatly to his knowledge of the forces, both chemical and physical, operating in them.

On the purely chemical side an exhaustive analysis of the various researches into the constitution of rosin and rosin oil by C. E. Soane (Vol. 5, No. 35), and a further series of researches into the mechanism of the drying of linseed oil, by S. Coffey (Vol. 6, No. 37) must be mentioned.

In view of the fact that paint plays so important a part in the protection of metals from corrosion, and that the President, Dr. J. Newton Friend, has been so prominently associated with work on the subject, it is only to be expected that this matter should have occupied the attention of the Association. A further paper by the President and one by Mr. U. R. Evans of Cambridge (both in the course of publication) on the more purely scientific aspects of the subjects, have been very instructive to those actually concerned in the solution of the problem. Very full accounts of the American work, particularly in connection with anti-fouling paint, have been contributed to the Journal by R. G. Browning (Vol. 6, No. 39 and Vol. 5, No. 33).

Turning to matters of more immediate practical interest, a paper by Noel Heaton (Vol. 6, No. 39) on the "Hydrogenated Derivatives of Benzene and Naphthalene," which have recently come into prominence both as paint solvents and as "thinners," and an account of the methods of producing an artificial standard daylight by A. D. Lang (Vol. 6, No. 36) may be quoted. The latter worker also dealt with the closely-allied subject of the measurement of the action of light upon colours by a standard method, a matter which is becoming increasing important in this country in view of the efforts to establish a dye and colour industry, which shall not only enable us to be independent of foreign products but also meet them upon equal terms in an open market.

The above review shows clearly, not only that the Association is keenly alive to the variety and complexity of the problems awaiting solution in the industry, but that it has succeeded in enlisting both the practical man from the works and the scientist from the research laboratory in the efforts to solve them.

The successful organisation and control of every industry must of necessity be based upon such a union, and it is the hope of the Association that the New Year will strengthen the bonds between science and industry and so increase both the value and extent of its efforts and the efficiency and utility of the oil and colour industries. T. H. B.

The Society of Dyers and Colourists

THE various sections of the society, centred in Bradford, Manchester, London, Huddersfield, Glasgow, and the Midlands have all been in full activity during the year, a full programme of lectures and works' visits having been carried through. The Bradford, Manchester and Leeds junior branches, mainly composed of students and the younger chemists in works, have also had a very successful year.

At the annual meeting held in Bradford in March, the Perkin Medal of the Society was presented to Mr. Chas. F. Cross, F.R.S., "For the Discovery of Viscose in 1892." This medal was instituted in 1907 in memory of Sir William Perkin, who was President of the Society at the time of his death, and is awarded at intervals of two or three years for discoveries or work of outstanding importance in connection with the tinctorial arts. The medal, which is struck in gold, is a notable work of art. It was designed by F. W. Pomeroy, A.R.A.; the obverse containing a life-like profile of the head of Perkin in high relief. The medal has previously been awarded to the following:—1908, Profs. Graebe and Liebermann (Synthesis of Alizarin); 1911, Prof. Adolf von Baeyer (Synthesis of Indigo); 1914, Comte Hillaire de Chardonnet (Artifical Silk); 1917, Prof. Arthur G. Green (Primuline); 1917, R. Vidal (Sulphur Black); 1919, Horace Lowe (Permanent Lustre on Cotton).

The Dyers' Company's Research Medal, which is awarded annually for the best paper published in the Society's Journal during the period, was awarded to Dr. S. Judd Lewis for his series of papers on "The Fluorescent Powers (the Spectro-Fluoriscometry) of Cellulose and other Carbohydrates. This work opens up a new field in the technology of the cellulose industries. The recipients of the Dyers' Research Medal in the

three previous years were Mr. C. F. Cross (Colloidal Tannin Compounds), Dr. A. E. Everest (Tinctorial Properties of some Anthocyans), and Professor G. T. Morgan (The Co-ordination Theory of Valency in Relation to Adjective Dyeing).

Amongst the important papers published during the year, the following may be mentioned: "The Ionamines, a new Class of Dyes for Acetate Silk" (A. G. Green and E. K. Saunders); "A New Class of Acid Dyes, the Sulphato Compounds," by the same authors; "The Bleaching of Yarn made from Bast Fibres" (E. Clayton); "Solvent Extraction of Cotton and Linen" (M. Fort); "Constituents of Raw Cotton" (E. Knecht and G. H. Streat); "The Application of Colour to Leather" (T. E. Bradbury); "Efficient Steam Generation in the Dyeing Industry" (D. Brownlie); "The Behaviour of Titanic and Stannic Acids towards Dyestuffs" (A. M. Morley and J. K. Wood); "Science in Public Affairs" (H. H. Hodgson); "Hydrogen Peroxide Bleaching" (I. E. Weber); "The Valuation of Dyestuffs by Titration" (R. B. Brown and H. Jordan); "The Fast Dye Industry" (J. I. M. Jones); "Adsorption" (J. W. McBain); "Fur Dyeing" (L. G. Laurie); "The Moisture Content of Wool" (S. A. Shorter); "The Evolution of Bleaching" (S. H. Higgins); "The Mechanism of the Formation of Azo Compounds" (T. K. Walker); "The Essential Partnership of the Chemical and Dyeing Industries" (Sir Max Muspratt).

The publishing activities of British scientific societies are usually confined to the issue of their official journals and such matter as the Annual Reports of Progress issued by the Chemical Society and the Society of Chemical Industry; but in response to an urgent demand and in the absence of any alternative source of publication the Council of the Society of Dyers and Colourists undertook the publication of a Colour Index. This has been a work of great magnitude, and was undertaken by the Society purely as a duty towards its members and the industries with which they are associated, and in no sense for profit.

The book has been issued in fourteen parts, of each of which no less than 150 proof copies were distributed for correction to a most influential Revision Committee, containing representatives of all the large colour manufacturers and consumers in the country, to foreign colour manufacturers, to colour users, to chemists with special knowledge of dyestuffs and to others in all parts of the world. The whole of this work of revision was of an honorary character. All colour makers of importance, with the exception of the German firms, availed themselves of the opportunity of revising and correcting the information regarding their products, and an enormous number of additional notes were also received from those engaged in all branches of dyeing, printing and other colour using trades. It is quite clear that no individual author or publishing firm could possibly have collected such a mass of reliable information as has been supplied to the Society by its members and other well wishers. It follows that the finished work is as complete and accurate in its information as it was humanly possible to make it.

The "Colour Index" is arranged in tabular form, the various columns giving (1) Trade Names of the Colour; (2) Scientific Name—Components—Formula; (3) Preparation; (4) Discoverer—Literature; (5) Description—Properties—Mode of Application; there is also provided a blank column of generous proportions in which manuscript notes may be made in order to keep the information up to date. The work will be the most complete index of colouring matters and their properties and uses in existence, being far more complete than the *Farbstofftabellen* of Prof. Gustav Schultz, hitherto the standard work on the subject. The number of synthetic dyes dealt with is 1,236 and the natural dyes, mineral pigments, etc., number 87. Most of the synthetic dyes have a number of commercial names—many of them thirty or more—and in all cases these names, and the respective makers, are given. The products of over one hundred colour making firms are dealt with.

A special feature of the work is the attention which has been paid to the indexing of the subject matter to make it as readily available as possible, the last of the fourteen parts in which the work was first issued being entirely devoted to the various indices, and these enable a dye user to see at once which firms make a particular dyestuff and the various commercial names under which it is sold. The book has been edited by Dr. F. M. Rowe.

W. M. G.

British Sulphate of Ammonia Federation

DURING the year under review the British Sulphate of Ammonia Federation, Limited, has continued to encourage improved methods of manufacture, with the result that about 70 per cent. of British sulphate of ammonia is now of neutral or acid free quality, and the sulphate made in this country is probably unsurpassed by any other sulphate in the world. The price has been kept within reach of the farmer, who can rely on a product which is always in a fit condition for immediate application to the land.

With regard to propaganda, the Federation's activities have generally followed the lines of previous years, relying mainly on the effect produced by a staff of competent agricultural advisers, who come into direct personal contact with actual and potential users of sulphate of ammonia. Experience has shown that this method has proved of immense benefit to the farming community.

Unfortunately, British agriculture is still in the throes of a great crisis, and the past two years have been difficult from the fertiliser selling point of view. However, it is in difficult times that propaganda work becomes of paramount importance, and some idea of the Federation's activities may be gathered from the fact that over 600,000 leaflets and pamphlets dealing with sulphate of ammonia have been printed during the year. A great impetus has been given to the sales of sulphate of ammonia in 7 lb. and 14 lb. bags by gas undertakings and manure merchants, thus catering in a special way for amateur gardeners and allotment holders. Display advertisements have appeared regularly in the principal farming and agricultural journals, and there are now few farmers in the country who are not well informed as to the merits of sulphate of ammonia. The agricultural advisers of the Federation are constantly inspecting farms by request, and they are able thoroughly to examine the soil and give an indication on the spot as to the lime and manurial requirements. These advisory visits are greatly appreciated by farmers who are always willing to learn more about the effect of agricultural fertilisers.

More than 250 field trials and demonstrations showing the effect of sulphate of ammonia have been carried out during the year, and all the principal agricultural shows in England, Scotland and Ireland have been attended by the Federation's representatives. A number of competitions have been organsied throughout this country, and in Ireland, and valuable prizes have been offered to successful farmers.

F. C. O. S.

Presentation to Chemist on Retirement

AN interesting presentation took place on Thursday, December 13, at the works of the Derby-Oxide and Colour Co., Ltd., Rugeley, from the employees to Mr. Archibald Campbell, who has retired from the managership of the company. Mr. Campbell is in his 83rd year, and has been manager for upwards of 25 years. The presentation was made by Mr. W. H. Giles, the chairman and managing director of the company. The gift took the form of a chair. Mr. Campbell commenced his career as a chemist in the works of Messrs. Charles Tennant and Co., Ltd., Glasgow. During that period he had close connections with Dr. Ludwig Mond, who, among other things, had come to this country for the purpose of working a process for the recovery of sulphur from alkali waste. Mr. Campbell was with C. Tennant and Co., Ltd., from 1862-1874, when he took up a position as chief chemist and assistant-manager to superintend a works belonging to the same firm on the Tyne. Mr. Campbell acted as secretary to the Tyne Chemical Society. He was afterwards connected with the Runcorn Soap and Alkali Co. While there he attended at Widnes the first meeting called to form a chemical society, which afterwards developed into the Society of Chemical Industry. He later took over the management of a works at Southampton, carrying on the manufacture of sulphuric acid, tar distillation, etc. After service in the vitriol industry in Scotland he went to America where he had the control at Pennsylvania of a bleaching powder works. Mr. H. A. Wilson, who had acted as assistant manager for some time, succeeds Mr. Campbell as manager of the company.

Ramsay Memorial Dinner

Tribute by Principal Irvine

A TRIBUTE was paid to the memory of Sir William Ramsay, the distinguished chemist, by Principal Irvine, of St. Andrews University, who presided at the Ramsay Chemical Dinner on Thursday, December 20, under the joint auspices of the Society of Chemical Industry, the Institute of Chemistry, the Society of Dyers and Colourists, the Glasgow University Alchemists' Club, the Andersonian Chemical Society, and the Ardeer Chemical Club.

Councillor Kennedy proposed the toast of the "Institute of Chemistry," and Principal Irvine (the Chairman) in responding, said he was delighted to think that they had taken the name of a great chemist, a great Scot, and a great Glaswegian, that of William Ramsay, in whose memory they were assembled together.

A Magnificent Worker

It had occurred to him to inquire why they had not chosen some other notable chemist. Why did they not take Thomas Graham, another chemist who lived and worked in Glasgow. They had preferred Ramsay to Graham, and he thought they were wise, because they had picked a man whose time was not so far away from their own, and they were able to picture the real man and to draw some inspiration from his life and character. What was it in Ramsay that had made his name so well known? It was his versatility, as shown in his work in Glasgow, in Bristol, and in University College, London. It was also in part his brilliancy. But that did not account altogether for his influence among his fellow-men; nor was it his genius, which was undoubted. Above all, it was his humanity. Those who knew Ramsay well would bear him out when he said that the man bore in his face and action the unmistakable imprint of a real sympathetic personality. A magnificent worker, he was an example to all by his industry. He was a brilliant talker, and it was a pleasure to listen to him. But above all he was a good listener, not only to men of his own status, but, to his credit be it said, he would listen willingly to the younger men. One of the keys to Ramsay's success in life was his control and influence over young men and the zeal with which he inspired them. If they were to take a lesson from his work and life, it would be to realise that he was a man of vision and did not hesitate to draw a bow at a venture. And how frequently he struck the target! They might think of the conditions under which Ramsay carried out some of his best work. His laboratory was a cellar. It was dirty and disordered, and his apparatus was antiquated, yet the work he carried out made British chemistry esteemed throughout the world. In that respect he was not alone. Time and again they would find great masters and great pioneers working under conditions such as he had described. Let them contrast that with the state of affairs in which people would turn aside from the path of duty on the plea that their laboratories were insufficient or ill-equipped.

The Future of Chemistry and Physics

Referring to a conversation which he had with Ramsay on the subject of helium, Professor Irvine gave a brief account of recent developments with regard to helium, and referred to the floating of an airship in America with that gas. When that airship was being deflated, he said, he had secured a large tube of helium which he has brought back with him to the old country, and which he exhibited to the assembly. Referring to the future of chemical science, the Chairman said he had great faith in Scotland, and he had little fear for chemistry, but, he asked, were we quite secure in our position regarding physics? He was greatly impressed by what he had seen of the equipment of laboratories in the United States for physical research. In this country, on the other hand, the returns showed that the number of students in physics was much smaller than the numbers going in for chemistry. He thought that such a state of affairs was not to the best interests of the country. His advice to the chemists of the West of Scotland—and he was proud to number himself among them—was to keep up their efficiency to the full, and not only must the subject of chemistry engage their attention, but also the other interests of life. He asked the chemists to keep alive their interest in literature and other things so that it might be known to the world that chemists were educated and cultured men.

Glasgow's Chemists

Mr. R. B. Pilcher, Registrar of the Institute of Chemistry, who proposed the toast of "The City of Glasgow," referred to the association of Glasgow with the chemical industry. Glasgow had provided a host of chemists of high competence and not a few of eminence, among whom were William Cullen, Joseph Black, Andrew Ure, Thomas Thomson, Thomas Graham, Thomas Anderson, and William Ramsay, while there were also others who happily were with us. Indeed, in connection with the chemical industry there were few cities which could claim to have surpassed the record of Glasgow. The Institute was, moreover, grateful to Glasgow for three distinguished past-presidents whose services would never be forgotten. He referred to Professor J. Millar Thomson, whose forbears were long associated with Chairs in the University; Sir George Beilby, for many years chairman of Glasgow's great Technical College; and Sir James Dobbie. To all these past-presidents the Institute and he personally were deeply indebted, and they honoured the city from which they came. He thought it was a remarkable fact that more candidates had presented themselves for the examination for the associateship of the Institute from the Royal Technical College of Glasgow than from any other college in the Kingdom.

Sulphide Corporation, Ltd.

THE twenty-seventh annual ordinary general meeting of the Sulphide Corporation, Ltd., was held on Thursday, December 20, in London. The Right Hon. the Earl of Kintore, K.T., G.C.M.G., chairman of the company, presided. The Secretary (Mr. C. R. Fisher) having read the notice convening the meeting and the report of the auditors,

The Chairman, in the course of his speech, said, owing to the disastrous outbreak of fire at the Central Mine in July it was thought prudent to declare a dividend of only 5 per cent. instead of the 10 per cent. hoped for. At their Cockle Creek establishment, owing to the suspension of smelting, productive work had been confined to the manufacture of superphosphates and sulphuric acid, both of which were produced last year on a considerably smaller scale than in the previous year. As regards superphosphate, they started the past year with a considerable stock on hand, and, owing to a severe drought which affected the agricultural districts of New South Wales, the demand was on a much reduced scale. They had therefore closed down their plant for a portion of the second half year, with the result that on June 30 last their stock was considerably reduced, the sales during the year having amounted to 20,984 tons. It had always been their policy to make the Cockle Creek works an important industrial concern, which would be a permanent source of revenue independent of the mine, and in pursuance of this policy they had been considering for some time past the establishment there of cement manufacture. For this important and growing industry they possessed at Cockle Creek special facilities owing to having on their land a large quantity of shale and clay suitable for cement making. The shale deposit had been fully tested and was estimated to contain at least 820,000 tons, or enough for 50 year's work with an annual output of 60,000 tons of cement a year. The other main requisite for cement production was limestone of pure quality, and to provide this they had purchased an area in the Tamworth district of New South Wales, which was estimated to contain several million tons of very high grade limestone, and was connected by rail with their works at Cockle Creek. With regard to the marketing of cement, they were favourably situated in being only 94 miles from Sydney and commanding the whole of the Newcastle and North Coast districts. In these circumstances they decided some months ago to construct works for the production of 30,000 tons of cement annually, which will be capable of quick increase to 60,000 tons, and contracts were placed in June last in this country for the necessary machinery, while preliminary work for its erection was commenced in Australia.

Decrease in Unemployment

THE number of persons on December 10, 1923, recorded on the live registers of the employment exchanges in Great Britain was 1,180,200. This was 14,520 less than in the preceding week, and 305,678 less than the figure recorded on January 1, 1923.

Chemical Merchants' Claim against Contractors

In an action, T. Paulding, Ltd., *v.* The Talbot Clearing House, heard at the Manchester Assizes, the plaintiffs, who are chemical merchants, sought to recover £260 damages from the defendants, haulage contractors, for breach of contract and negligence.

It appeared that in November of last year the plaintiffs employed the defendants to convey from a London wharf to Manchester 35 drums of carbon bisulphide. They in turn employed sub-contractors. The plaintiffs, in communications to the defendants, stated that the goods to be conveyed, while of a dangerous nature, were quite safe if carefully handled; it was important that the drums should be securely fastened, and no drums should be accepted which showed any signs of leakage. It was showed that when the goods were loaded up on January 2 there were in fact two drums which were leaking. On the next day the motor-wagon, petrol-driven, had reached Cannock, and while it was standing the whole wagon, with its load, was destroyed by fire owing to the leakage from the two drums. The plaintiffs accordingly claimed for the loss, alleging that the defendants had failed to carry out their instructions.

On the part of the defendants it was urged that they were not liable, as the goods were sent at the risk of the plaintiffs, that the arrangement with the plaintiffs (which they denied) was that they should insure against loss by fire, and that the drums in which the carbon bi-sulphide was carried were not suitable for the purpose. It was brought out in evidence that the defendants had given to the sub-contractors the same warning that had been given to them as to the need for securely fastening the drums, and as to not accepting leaking drums.

Judgment was given for the plaintiffs for £227, or less the counter-claim, with costs and the costs of the counter-claim to a given date.

The Manufacture of Optical Glass

At a meeting of the Royal Philosophical Society of Glasgow held on Wednesday, December 19, Dr. James Weir French described in detail the principal manufacturing processes of optical glass. All the ingredients, he said, must be of the purest quality, and particularly free from iron, a very minute quantity of which sufficed to colour the glass green and reduced its clearness. Sand of an exceptionally pure character was imported from Fontainebleau, and from France there were also obtained several varieties of very pure fire-clay, from which the refractory glass pots were made. These materials, if derived from British sources—as would be the case in time of war—required to be purified. By varying the composition, the required optical constants of any particular type of glass could be obtained. Of a particular series of types of glass, only those covering a very small range were available for optical purposes. At the one end of the series the glass might be unstable as regarded weathering by the atmosphere. The types at the other end might be unstable as regards devitrification. After stirring the pot of molten glass, to remove veins and gas-bells and to improve homogeneity, it was removed from the furnace and surface-chilled by a spray of water. The glass was then allowed to cool down at a rate just sufficient to break it into pieces of a useable size. Selected pieces were moulded into blocks of the sizes required, and after examination those that had passed the inspectors were passed through a fine-annealing furnace. Good definition then depended upon the homogeneity and freedom from strain of the optical glass. It was rarely the case that in these respects perfection of the material was completely attained, and it must be the object of the optical glass-maker not only to improve the quality of the glass, but also to evolve new types. This could only be done by continuous experiment.

Coming Chemical Engineering Meetings

The following meetings have been arranged by the Chemical Engineering Group during the coming months. On January 25, 1924, a Symposium is being arranged on "The Treatment of Water for Industrial Purposes." It is proposed to invite contributions from various authoritative sources and illustrate such contributions by samples, diagrams, models of plant, photographs, etc. On February 29, a paper is to be given in London on "Kinetic Elutriation," by Mr. L. Andrews, M.Inst.C.E., M.I.E.E. On Tuesday, March 4, a joint meeting is to be held in Hull with the Hull Chemical and Engineering Society, with a paper on "Centrifugal Dryers and Separators: Their Construction and Use," by Mr. E. A. Alliott, M.I.Chem.E., A.Inst.M.E. This paper will be given at the Hull Photographic Society's Rooms, Grey Street, Park Street, Hull, at 7.45 p.m. On March 24 a discussion is to be proposed on "Chemical Works Costs," by Mr. F. M. Potter, F.I.C. This will take place in London. In addition to the foregoing, arrangements are in hand for the preparation and delivery of papers during the session on the undermentioned subjects:—

(*a*) "Adsorbents, with Special Reference to Silica Gel," by Professor E. C. Williams (Ramsay Professor of Chemical Engineering at University College); (*b*) "Activated Carbon," by Major V. F. Gloag; and (*c*) "The Routine of a Technical Laboratory," by Mr. S. R. Joyce (of Centrifugal Separators, Ltd.). It is also hoped to arrange a Conference some time during 1924 on the subject of "Crystallisation."

Members of the Group and others who are interested who have special knowledge or experience of any subjects to be treated in the above list of papers are invited to attend the meetings and contribute to the discussion. Written contributions are admissible and will be read at the meetings, in case the author thereof is unable to be present.

New Explosives Factory in Chile

According to information recently received from Valparaiso, a new explosives factory has been opened at Rio Loa (Calama) of the Compañia Sud Americaña de Explosives, a Chilian registered company. It has an authorised capital of £1,000,000 and a subscribed capital of £600,000, the majority of the shares of the company being owned jointly by the three well-known manufacturers—Nobel Industries, Ltd., of London; E. I. du Pont de Nemours and Co., and the Atlas Powder Co., of Wilmington, Delaware, U.S.A. These three companies in the past have been the principal suppliers of explosives in Chile, but they have now placed their business in the hands of the new Chilian company. The capacity of the Rio Loa works is about 500 cases (11,300 kilos) of explosives per day. All standard grades of commercial explosives will be manufactured, and the excellent position of the factory will enable it to supply the high explosves consumed by the mines and nitrate oficinas throughout the north of Chile and also by the industries of Bolivia. The Government, in addition to numerous other concessions, has granted the company the right to the use of the water of the Rio Loa for generating power.

A New Synthesis of Benzene

The classical experiment of Berthelot on the polymerisation of acetylene to benzene, made so far back as 1858, was a fundamental synthesis of benzene, and is still quoted in the text-books. The yield of benzene and allied hydrocarbons, however, was so small that much experimental skill was necessary to prove their presence. The results were not greatly improved by the use of catalysts, the main action in all cases being the decomposition of the acetylene into its elements. In the *Comptes rendus* of the Paris Academy of Sciences recently, M. N. D. Zelinsky describes experiments on the polymerisation of acetylene in the presence of activated wood charcoal at 640° to 650° C. Under the conditions described, more than 70 per cent. of the weight of the acetylene passed over the charcoal was converted into liquid products. From this liquid absolutely pure synthetic benzene (303 gm.) was obtained, and other substances isolated from the condensate included toluene, *p*-xylene, styrol, indene, naphthalene, fluorene, and anthracene.

Italian Potash Deposits

Mr. Alexander M. Cameron, Lasswade, in his annual report to the Fife Analytical Association, states that a new industry that was being developed in North Italy had during the past year become firmly established. This consists of working up a volcanic mineral known as leucite, which is found in immense quantities. It is a silicate of alumina and potash, and is worked for the production of cement, aluminium, and potash salts. It contains over 20 per cent. potash. It is anticipated that the supplies of potash will rival those from the German and Alsatian deposits.

From Week to Week

ON BOXING DAY 2,480 persons visited the Science Museum at South Kensington, London.

A REDUCTION in the retail prices of "Celanese" Artificial Silk has been announced by British Celanese, Ltd.

DURING NOVEMBER the largest purchasers of British sulphate of ammonia were the Dutch East Indies and Japan.

PLANS OF A dye-stuffs and chemical store, to be erected at their Paisley works at Laighpark by the British Cotton and Wool Dyers' Association, Ltd., have been passed by the Paisley Dean of Guild Court.

THE PHYSICAL SOCIETY of London and the Optical Society will hold their fourteenth annual exhibition of electrical, optical and other physical apparatus at the Imperial College of Science, South Kensington, on January 2 and 3. About fifty firms have arranged to send exhibits.

AT A SCIENTIFIC MEETING of the Pharmaceutical Society at Edinburgh on Wednesday, December 19, Mr. D. B. Dott, F.I.C., submitted laboratory notes on "The Determination of Solubility," indicating how discrepant records arose through supersaturation even in presence of crystals.

IT IS REPORTED that the Swedish engineer, M. Cornelius, has invented an electrical accumulator furnace by which fully exact temperatures can be attained for tempering, welding and forging. Experiments with the furnace have been made at the Trollhattan mechanical workshop.

THE LORD MAYOR of Birmingham has opened a fund for the relief of the unemployed. The first list of contributions includes the names of the Midland Vinegar Co., Ltd., £100; Southall Brothers and Barclay, £100; Mr. W. A. Albright, £25; Mr. Thomas Barclay, £25; and Alderman F. C. Clayton, £50.

THE MANUFACTURERS of American insulin announce an increase of 40 per cent. in the value of the unit of activity, and have issued a new scale of dosage. It is explained that this has been done in order to bring the activity of American insulin in line with that produced in London and Toronto.

THE ASSOCIATION OF BRITISH CHAMBERS OF COMMERCE intends to consider postal questions at a special conference of delegates from all parts of the country to be held in Birmingham in January. The most important point is that relating to the re-instatement of the penny post, which would, it is strongly urged, be an immense advantage to business generally.

DR. G. D. LIVEING, the first professor of Chemistry in the University of Cambridge, celebrated his 96th birthday on Friday, December 21. He attended a dinner at St. John's College in the evening, and his health was proposed by the Master. Dr. Liveing took his degree in 1850 and has resided in Cambridge ever since. He was professor from 1861 to 1908.

IT IS REPORTED that a valuable deposit of barytes has been discovered about 25 miles from the town of Kinka, Kogen Province, Corea. The discovery was made in 1918, but quarrying operations did not commence until the spring of this year. The output is said to be about 2,000 tons to 3,000 tons per month, the quality good, and the grade of the ore about 91 per cent.

THE BAILLIE LIBRARY, which was established in the department of chemistry of McGill University, Montreal, by the late Mr. John Baillie, who made a donation of $25,000 for this purpose, was formally opened on Tuesday, December 11. Dr. Ruttan, the director of the department, announced that this library would soon become an extremely valuable reference library, as it already possessed thirty-nine sets of the leading chemical journals in various languages, most of the sets being complete.

AT THE INQUEST held on Albert Jacques, a labourer who was killed in an explosion at Esholt, Bradford, when carrying gelignite in his pocket, it was stated that in cold weather it was necessary at times to warm the gelignite, which was done by placing it in a warming pan surrounded by boiling water, the men often carrying the gelignite to the water in their pockets. When soft, the gelignite could be lit without fear of explosion, but if dropped on a hot surface when hard or frozen it might explode. A verdict of accidental death was returned.

THE DAY COURSE in dyeing and bleaching, held in the Chemistry Department of the Nottingham University College for the first time last session, was attended by ten advanced chemistry students, seven of whom were graduates. Unfortunately, there are very few openings for chemists in the lace and hosiery industries of the district, and this fact prevented many students from taking this specialised training. The short courses on bacteriology, instituted by the Department of Biology, have been attended by 17 chemistry students, of whom ten were graduates.

THE FOLLOWING CONTRIBUTIONS will be made in the New Year at the meetings at the Birmingham University of the Birmingham and Midland Section of the Society of Chemical Industry. January 15, Mr. J. Ivon Graham, "The Spontaneous Combustion of Coal"; January 31, Mr. H. T. Tizard, "Some Special Problems in Volumetric Analysis"; February 5, Mr. E. J. Lush, "Some Studies in the Kinetics of Oil Hydrogeneration"; February 21, Mr. N. J. Price and Mr. C. S. L. Hawkins, "A New Determination of the Specific Gravity of Solutions of Ammonia"; and March 18, Mr. A. W. Knapp, "The Fermentation of Caçao." Professor G. T. Morgan will deliver his Presidential Address before the members of the Chemical Society of the University of Birmingham on January 21. On February 4, Mr. D. G. Skinner will lecture on "Glass and its Chemical Nature;" February 18, Mr. G. E. F. Forstner on "Vitamins: their Chemistry and Importance to Life;" March 4, Mr. F. W. Aston on "Atomic Weights and Isotopes"; and March 17, Mr. R. L. Wormell on "Ionisation in Non-aqueous Solvents."

AT the Fife Analytical Association's annual meeting held at Cupar on Christmas Day, Mr. A. W. Waldie presiding, office-bearers for the year were appointed as follows:—President, Mr. A. W. Waldie; vice-president, Mr. G. R. M'Garva, estate office, Colinsburgh; secretary, Mr. F. W. Christie, Cupar; treasurer, Mr. J. Methven Mitchell, solicitor; executive committee, Messrs. W. C. Ferguson of Foxton; W. M. Johnston, Foodie; J. Storrar, Melville Home Farm; R. J. Murray, Kincaple; J. S. Rodger, Kellie Castle; John Howie, Newark; Henry Masterton, Kirkcaldy; David Black, Tillybreck; Jas. F. Thom, Markinch; Sinclair, Dunfermline; the Earl of Elgin, and James Miller of Waulkmill. The accounts were submitted and disclosed a deficit on the year's working. It was urged that if the association was dropped and the County Council took up their duties, the whole cost of the analyses of the samples would fall on the farmers who called on the Council to administer the Act. Mr. Black said if they let the association go out of existence they would be at the mercy of the manure and cake merchants. The Secretary said they had nearly 600 members. The subscription was only 2s. 6d. per annum. On the motion of Mr. M'Garva, seconded by Mr. J. M. Roger, it was agreed to double the subscription.

The Peachey Process Co.

AT the annual ordinary general meeting, held in London on December 14, the chairman, Sir Robert W. Gillan, said that in the commercial exploitation of the Peachey Process the most important event had been the launching of Peachey Leather Products, Ltd., who had taken a licence for compounded leather manufactures on the basis of 4½ per cent. royalty on works' selling price. One-third of this would accrue in shares. Another important line was floor coverings, for which an option had been given; £2,500 had been paid for this and another £7,500 and a royalty on production would be paid if and when the option were taken up. A third application of the Process was to the proofing of goods where there was no doubt that the Peachey Process had many advantages over the old method.

The vulcanisation of raw rubber articles had been carried out by Plantation Rubber Manufacturing Co., and "Cold Process Rubberware, Ltd.," had been formed for the manufacture of moulded goods.

Turning to the foreign rights, he stated that a cable had been received from the U.S.A. to say that the final appeal against the issue of a patent there had been dismissed. The company were to be congratulated on this successful ending to the prolonged litigation. In other foreign countries their experience was that a successful conclusion to negotiations was not to be looked for until the Process was operating in Great Britain. In Belgium, however, their licensee had already begun, and had produced excellent results.

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The influence of oxalic acid on the formation of aniline black. J. Piccard. *Helv. Chim. Acta*, December 1, 1923, pp. 1,029–1032.

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ETHYLENE.—The preparation of pure ethylene. L. Moser and F. L. Lindinger. *Monats. für Chem.* (*Vienna*), October 26, 1923, pp. 141–150.

CATALYSIS.—Catalytic metals. J. Piccard and E. Thomas. *Helv. Chim. Acta*, December 1, 1923, pp. 1,044–1,045.

Patent Literature

Abstracts of Complete Specifications

207,258. Manufacture of Combustible Gas, or Gases, Process of and Means for. C. F. Broadhead, "Nestlebrae," Junction Road, Clayfield, near Brisbane, Australia. Application date, August 22, 1922.

The apparatus is for producing a constant quantity and quality of combustible gas with a given automatically regulated supply of air, steam, and fuel. Three separate generators are used, each with vertical retort and water-gas generator, and each is fitted with gas, steam and air and tar connections, and also additional gas connections at the base. These connections are connected to centre valves operated by a vertical shaft to obtain the desired cycle of operations. Each generator has a vertical double-walled retort superposed on a water-gas generator, which is fed from it. In one generator, water-gas is made by passing steam downwards through it, and the water-gas is passed upwards through the next generator and through the coal descending through the retort, so that the coal is distilled by the heat of the water-gas. The third generator is blown while these operations are carried out, and each unit passes through the various operations in a cycle. The heat of the hot blow gases is recovered by passing them through the jacket surrounding the vertical retort, to assist in distilling the coal in the retort. The blow gases also superheat the steam for the production of the water-gas. Tar may be introduced and gasified simultaneously during the downward steaming of one bed of fuel, and all the operations are carried out automatically by the operation of the valves from a common shaft.

207,275. Oil Colours and Printers' Inks, Process for Making. Plauson's (Parent Co.), Ltd., 17, Waterloo Place, Pall Mall, London, S.W.1. From H. Plauson, 26, Jarrestrasse, Hamburg, Germany. Application date, August 28, 1922.

In the preparation of organic and inorganic colours or pigments by dispersion with water in a colloid mill by the process described in Specification No. 155,836 (see The Chemical Age, Vol. IV., p. 313), the excess of water is removed by ultra-filtration or otherwise, and the pigment dried *in vacuo*. Although the particles of such a pigment may exhibit Brownian motion when suspended in water, it is difficult to distribute the dried pigment in oil to a fine state of subdivision. This is probably due to the existence of a very thin adsorbed layer of water on the particles of powder, and the difficulty may be avoided by wetting the dried material with an organic solvent capable of dissolving oil or the previous dispersion medium, and then removing the solvent by heating. Suitable solvents are low-boiling alcohols and ketones, esters, and ethers, alone or mixed with hydrocarbon and/or a suitable oil. It is desirable but not absolutely necessary that the solvent should be miscible with water. The layer of water is replaced by a layer of the solvent, which does not prevent subsequent distribution in the oil. In an example shale or slate powder is dispersed in a colloid mill to form a grey pigment, which is dried and then moistened with alcohol which may contain a very small quantity of paraffin and/or linseed oil. The alcohol is evaporated by heating to 50°–60° C., yielding a pigment which can be uniformly incorporated with oil. Other mineral and organic colours may be treated in a similar manner.

207,337. Paper from Peat, Process for the Production of. Plauson's (Parent Co.), Ltd., 17, Waterloo Place, Pall Mall, London, S.W.1. From H. Plauson, 26, Jarrestrasse, Hamburg, Germany. Application date, October 18, 1922.

Freshly cut peat is disintegrated, and then boiled with milk of lime and sodium sulphate, sodium sulphite or carbonate, or other substances yielding these by interaction. The cellulose material obtained is bleached and neutralised, and may then be used as a material for the production of paper. A superior product may be obtained by boiling with large quantities of milk of lime under increased pressure in an autoclave. In an example, 100 parts of the peat are treated with milk of lime containing 10 parts of calcium hydroxide, and 5 parts of sodium sulphate are then added, the mixture being heated by superheated steam. Bleaching is effected by chlorine, the lye is removed, and the cellulose washed with water, neutralised with ammonia, washed and dried.

207,366. Distillation, Method of. Thermal Industrial and Chemical (T.I.C.) Research Co., Ltd., and J. S. Morgan, 52, Grosvenor Gardens, London, S.W.1. Application date, November 13, 1922.

The method is for separating the constituents from a liquid mixture containing more than two constituents. The method consists in passing steam through part of the mixture to vaporise two constituents, condensing one of the constituents from the mixture of steam and vapour, and then passing the steam through another part of the mixture to vaporise one constituent, and repeating the treatment of the steam and vapour. The process is particularly suitable for distilling coal-tar. The tar is pumped through a series of heat interchangers in which it is heated and the various fractions condensed. This usually removes water and light spirit, and the tar is then heated by forcing it through a bath of molten lead to a temperature which removes the remaining volatile constituents except the anthracene. The pitch and anthracene are sprayed by means of superheated steam as described in Specification No. 184,624 (see The Chemical Age, Vol. VII, p. 423). The anthracene only is condensed out from the mixed vapours, and its latent heat is used in heating the tar. The uncondensed steam is mixed with the vapour from the lead bath and the mixture is passed into a reflux condensing column, so that light oil vapour and steam leave at the top and heavy oil is discharged at the base. The light oil and steam are condensed by the cold tar, which is thereby preheated.

207,476. Vat Dyestuffs derived from Anthraquinone, Manufacture of. O. Y. Imray, London. From Society of Chemical Industry in Basle, Switzerland. Application date, April 30, 1923. Addition to 195,753.

Specification No. 195,753 (See Chemical Age, Vol. VIII., p. 519) describes the treatment of derivatives of 1 : 2-napthoquinone containing mobile substituents with amino-anthraquinones other than ortho-diamino-anthraquinones, and the products are condensed with ortho-diamino-anthraquinones. In the present invention the derivative of 1 : 2-napthoquinone containing a mobile substituent is first condensed with the ortho-diamino-anthraquinone, and this product is treated with the mono- or di- α-amino-anthraquinone. The new dyestuffs thus obtained are somewhat similar to those described in Specification No. 195,753, but are soluble in concentrated sulphuric acid, yielding brown solutions. A brown vat which dyes cotton brown tints may be obtained with hydrosulphite and caustic soda. In an example, a mixture of 6-bromo-1 : 2-naphthoquinone and 2 : 3-diamino-anthraquinone is heated with glacial acetic acid, cooled, filtered, and washed. The product is boiled in a reflux apparatus with α-amino-anthraquinone, anhydrous sodium acetate, anhydrous cupric chloride, and nitrobenzene. The product is washed with alcohol, hydrochloric acid, and water, and then dried. Examples of other similar dyestuffs are given.

207,276. Hydrocarbon Compounds of Lower Boiling Point from those of Higher Boiling Point, Process and Apparatus for Producing. A. E. Alexander, London. From U.S. Gasoline Manufacturing Corporation, 136, Liberty Street, New York. Application date, August 28, 1922.

A high boiling oil such as petroleum is heated under pressure solely by means of hydrocarbon gas and vapour, which is heated to a temperature sufficient to dissociate the high boiling compound into lower boiling compounds, such as petrol. The pressure and temperature are produced independently of one another. The vapour evolved during the process may be mixed with the gas which is used for heating the oil, and the mixture may be used for preheating the oil before subjecting it to its final heating. The gas and vapour are heated to a temperature sufficient to crack the vapour, and to crack the vapour evolved from the heated petroleum. The resulting gas and vapour are used to crack

petroleum in a counter current apparatus, and the higher boiling fractions are condensed from the mixture thus obtained. These heavy condensates are returned continuously to the system, and the remaining gas and vapour are cooled, and condensed to recover the low boiling constituent desired. The uncondensed vapour and gas are compressed to maintain the desired pressure in the system. This process avoids subjecting the oil to excessive temperatures by external heating in a still whereby a considerable proportion of the oil is converted into carbon, heavy tar, hydrogen, and other light gases. A detailed description of the apparatus is given.

NOTE.—Abstracts of the following specifications, which are now accepted, appeared in THE CHEMICAL AGE when they became open to inspection under the International Convention: 195,390 (Farbenfabriken vorm. F. Bayer & Co.), relating to the manufacture of active charcoal, see Vol. VIII., p. 600; 199,718 (Farbenfabriken vorm. F. Bayer & Co.), relating to apparatus for producing intimate mixture between gases and liquids, see Vol. IX., p. 237; 199,743 (P. L. Guilleminot), relating to sulphonation of fatty substances of animal origin, see Vol. IX., p. 238.

Specifications Accepted, with Date of Application

180,900. Methane, Manufacture of. Farbwerke vorm. Meister, Lucius & Brüning. October 4, 1921. Addition to 146,110.

188,634. Caliche, Methods and processes for the leaching of—and for the recovery of nitrate therefrom. Guggenheim Bros. November 7, 1921.

195,089. Ferric oxide, Manufacture of colloidal solutions of. Aktieselskabet Hydropeat. March 18, 1922.

196,579. Glycerine and alkali soaps, Process of manufacturing. L. Schmidt. April 21, 1922.

198,645. Sulphate of chromium, Processes of manufacturing. O. Nyedegger. May 31, 1922.

200,788. Rubber and the like, Process for the vulcanisation of. Naugatuck Chemical Co. July 13, 1922.

201,510. Cellulose esters, Process of manufacturing. Soc. de Stearinerie et Savonnerie de Lyon. July 29, 1922.

207,840. Dyestuff intermediates, Manufacture of. J. Thomas and Scottish Dyes, Ltd. July 8, 1922.

207,851. Combustible gases, Manufacture of. C. F. Broadhead, F. G. Barker and P. C. H. Hunt. September 1, 1922.

207,902. Pipes for use when immersed in chemical liquids. F. Judson, J. M. Gibson and H. Galloway. September 15, 1922.

207,919. Paints, and method of manufacturing the same. Plauson's (Parent Co.), Ltd. (*H. Plauson.*) September 25, 1922.

207,977. Concentrating ores, Process of. F. W. Golby. (*Luckenbach Processes, Inc.*) November 13, 1922.

207,995. Gas purification, Method of and apparatus for use in. W. B. Davidson. November 25, 1922.

208,176. Regenerative furnaces. H. M. Ridge. May 13, 1922.

Chemical Manufacturer's Failure

THE public examination of Edmund Herbert Wrigglesworth, chemical manufacturer, 369, Spring Bank West (late St. Andrew's Works, Mason Street), Kingston-on-Hull, was held on Tuesday, December 17. The debtor stated that in 1914 he became a chemical merchant, and in 1918 he began to manufacture his own chemicals and was successful, employing about 200 hands. Subsequently the business was converted into a limited company, with a subscribed capital of £20,000 and debentures of £5,000. The debtor received 5,000 shares for his interest. In December, 1920, the company went into liquidation, and nothing had been paid to the creditors or contributories. He attributed his failure to the loss of £5,000 in the liquidation of the company and to making himself liable for £4,400 in respect of guarantees given to the bank, also for machinery, and to the railway company. The examination was closed.

Wear Resisting Treatment for Fabrics

CAPTAIN H. R. HEALY, a Southport analyst, claims to have discovered a method for chemically treating certain fabrics by a special process so as to render them wear-resisting. A number of tests have been made, and satisfactory results have been attained. The first application of this process has been made by the Rexean Co., Ltd., Southport, which have employed it in the manufacture of solid flaxen cords for use with a type of men's braces which are known as "Rexean-Presidents."

Chemical and Metallurgical Corporation

AT the third ordinary general meeting, held in London on Monday, December 17, the chairman of the company, Mr. Herbert Guedalla, said that since the last meeting, works at Stratford had been erected for the demonstration of their process on a commercial scale. These works were now nearing completion, and would, as indicated in the report, come into operation early in the new year. The treatment of complex lead-zinc sulphide ores had continued to attract the attention of all interested in the metallurgical treatment of ores of this character. All attempts at the complete physical separation of the constituents of these ores in order to effect high-metal recoveries at low cost had proved unsuccessful. Metallurgical methods for the treatment of ores were moving slowly, but surely, in the direction of the elimination of pure pyro-metallurgical operations. Already there were outstanding instances of the success which had attended the use of what may be called more refined methods of the extraction of metals from their ores, and there could be little doubt but that the corporation's processes, as applied to complex zinc lead sulphide ores, would be added to such list of successes. By chemical methods of separating the metal values of an ore it was possible to obtain these constituents directly entirely free from admixed impurities in a manner quite impossible by older methods involving only mechanical separation and smelting.

The work during the past year had shown that numerous by-products could be produced, and the result was that the value of these by-products, quite unobtainable by existing metallurgical processes, would probably result in their being able to separate lead and zinc from their complex ores at an extremely low figure. It was possible by the company's processes to extract directly from a complex ore in substantially one operation the whole of the lead, leaving the bulk of the zinc constituents of the ore free from lead. At the same time, in the course of these operations they prepared valuable compounds of zinc.

A Filing System for Chemical Managers

WHERE any large business is handled, such as in chemical manufacture, a compact file of facts is invaluable, and this has been recognised by the originators of the "Lefax" filing system. In this system all matter is on small pages 6¾ by 3¾ in. punched for fitting into a pocket book or a filing cabinet. The great point in the system is that a range of compact printed notes abstracted from authoritative sources is available on various subjects, which may be purchased as required and supplemented by personal notes on blank sheets from time to time. The subjects covered in this range of "data-sheets" deal with costs, general, mechanical, electrical, chemical, agricultural and other matters. In the list issued by the distributors in this country, Norman and Hill, Ltd., 54, Holborn Viaduct, London, E.C.1, there are some 200 entries of sheets relating to chemical points, such as the properties of different compounds, analytical methods, etc. Although of American origin, these sheets should be very handy here owing to their general value. Additional numbers are being added continually, so that the files may be kept up-to-date.

British Dyes for U.S.A.

H.M. CONSUL-GENERAL at Philadelphia (Mr. F. Watson, O.B.E.), reports that he has received an inquiry for British-made dye powders, soluble in non-drying oil, in black, red and blue for use in the process of inking typewriter ribbons. United Kingdom firms desirous of receiving further particulars regarding this inquiry should apply to the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1., quoting reference 21437/F.W./C.C./(2).

Potash Deposits in Sweden

RICH deposits of potash-bearing mineral have recently been discovered in Sweden, south-west of Stockholm. The amount is said to be about 40,000,000 tons, which it is hoped will gradually be available to replace the present imports of 20,000 to 30,000 tons annually.

Scottish Chemical Market

The following notes on the Scottish Chemical Market are specially supplied to THE CHEMICAL AGE by Messrs. Charles Tennant and Co., Ltd., Glasgow, and may be accepted as representing the firm's independent and impartial opinions.

Glasgow, December 27, 1923.

OWING to the holiday intervening, the amount of business transacted during the past week has not been great.

There is little of importance to record, therefore, prices being on about a level with those last named.

Industrial Chemicals

ACID ACETIC.—Export inquiries still being received. Glacial, 98/100%, £60 to £66 per ton; 80% pure, £49 to £50 per ton; 80% technical, £47 to £48 per ton, packed in casks, delivered c.i.f. U.K. port, duty free.

ACID BORACIC.—Crystals or granulated, £48 per ton; powdered, £50 per ton, carriage paid U.K. stations, minimum ton lots.

ACID CARBOLIC, ICE CRYSTALS.—Now on offer at about 11¾d. per lb.

ACID CITRIC, B.P. CRYSTALS.—Unchanged at about 1s. 4¾d. per lb., less 5 per cent. ex store, in little demand.

ACID FORMIC, 85%.—Spot material still available at about £62 per ton, ex store.

ACID HYDROCHLORIC.—In little demand. Price 6s. 6d. per carboy, ex works.

ACID NITRIC, 80°.—£23 10s. per ton, ex station, full truck loads.

ACID OXALIC.—Moderate inquiry. Price about 6d. per lb., ex store, spot delivery.

ACID SULPHURIC.—144°, £3 12s. 6d. per ton; 168°, £7 per ton, ex works, full truck loads. Dearsenicated quality, 20s. per ton more.

ACID TARTARIC, B.P. CRYSTALS.—Inclined to be easier at about 1s. per lb., less 5 per cent. ex wharf.

ALUMINA SULPHATE.—17/18% iron free, quoted £8 5s. per ton, c.i.f. U.K. port, prompt shipment. Spot lots obtainable at about £8 12s. 6d. per ton, ex store.

ALUM, CHROME.—Price unchanged at £26 to £28 per ton, according to quality, delivered f.o.b. U.K. port.

ALUM, POTASH (LUMP).—English material unchanged at about £10 17s. 6d. per ton, f.o.b. U.K. port. Spot lots of continental material still available at about £11 10s. per ton, ex store.

AMMONIA, ANHYDROUS.—Unchanged at about 1s. 5d. per lb., ex station, prompt delivery.

AMMONIA CARBONATE.—Lump, £29 5s. per ton; powder, £31 per ton, f.o.b. U.K. port for export.

AMMONIA LIQUID, 880°.—Unchanged at 3d. per lb., delivered. Containers extra.

AMMONIA MURIATE.—Grey galvanisers quality, inclined to be scarce, quoted £34 to £35 per ton, ex station. Fine white crystals on offer at about £27 15s. per ton, ex store, spot delivery.

AMMONIA SULPHATE.—25½% material, £13 2s. per ton; 25¾% neutral quality, £14 5s. per ton, ex works, December delivery.

ARSENIC, WHITE POWDERED.—Moderate inquiry, spot lots quoted about £71 to £72 per ton, ex store. Continental material on offer at about £65 per ton, c.i.f. U.K. port.

BARIUM CHLORIDE, 98/100%.—English material unchanged at about £15 per ton, ex store.

BARYTES.—Finest white English unchanged at £5 5s. per ton, ex works. Good quality continental material offered at £5 per ton, c.i.f. U.K. ports.

BLEACHING POWDER.—Price £11 5s. per ton, ex station, spot delivery, contracts 20s. per ton less. Manufacturers advise a reduction of 5s. per ton in the price to be charged as from January 1 next.

BORAX.—Granulated, £24 10s. per ton; Crystal, £25 per ton; Powdered, £26 per ton, carriage paid U.K. stations. Minimum ton lots.

CALCIUM CHLORIDE.—English material unchanged at £5 12s.6d. per ton, ex station. Manufacturers advise no change in price over next year. Continental offered at about £4 15s. per ton, ex store.

COPPERAS, GREEN.—Quoted £2 5s. per ton, f.o.b. U.K. port.

COPPER SULPHATE.—Moderate export inquiry. Price now about £25 per ton, less 5% f.o.b. U.K. port.

FORMALDEHYDE, 40%.—On offer at £64 per ton, ex store, but could probably be obtained for less.

GLAUBER SALTS.—Fine white crystals quoted £3 12s. 6d. per ton, ex store, spot delivery. Continental material still offering at about £3 per ton, c.i.f. U.K. port.

LEAD, RED.—English material unchanged at £45 per ton, carriage paid U.K. station. Continental about £37 per ton, c.i.f. U.K. ports. Spot material available at £37 15s. per ton, ex store.

LEAD, WHITE.—Cheaper continental quotations. Now offered at about £39 15s. per ton, c.i.f. U.K. port.

LEAD ACETATE.—Continental white crystals now quoted about £46 per ton, ex store, spot delivery. English material for export at about the same price, delivered f.o.b. U.K. port.

MAGNESITE, CALCINED.—Finest English material offered at £8 per ton, ex station.

MAGNESIUM CHLORIDE.—Unchanged at about £3 15s. per ton, ex store, spot delivery. Still on offer from the continent at about £2 12s. 6d. per ton, c.i.f. U.K. port.

MAGNESIUM SULPHATE (EPSOM SALTS).—Commercial quality offered at about £5 per ton, ex store; B.P. quality, £6 5s. per ton, ex station, prompt delivery.

POTASH, CAUSTIC, 88/92%.—Spot material unchanged at about £34 per ton, ex store. Offered from the continent at about £30 per ton, c.i.f. U.K. port.

POTASSIUM BICHROMATE.—Unchanged at 5¾d. per lb., delivered.

POTASSIUM CARBONATE, 96/98%.—Spot material still available at about £30 per ton, ex store. Offered from the continent at about £26 10s. per ton, c.i.f. U.K. port.

POTASSIUM CHLORATE.—Unchanged at about 3½d. per lb., ex store.

POTASSIUM NITRATE (SALTPETRE).—Quoted £32 10s. per ton, ex store, spot delivery.

POTASSIUM PERMANGANATE, B.P. CRYSTALS.—Unchanged at about 10½d. per lb., ex store, spot delivery.

POTASSIUM PRUSSIATE (YELLOW).—Moderate export inquiry, quoted 10½d. per lb., f.o.b. U.K. port. Spot material on offer at about 10½d. per lb., ex station.

SODA CAUSTIC.—76/77%, £19 7s. 6d. per ton; 70/72%, £17 17s. 6d. per ton; 60/62% broken, £19 2s. 6d. per ton; 98/99% powdered, £22 15s. per ton. All ex station, spot delivery. Contracts, 20s. per ton less. Manufacturers advise no change in price for next year.

SODIUM ACETATE.—Unchanged at about £26 5s. per ton, ex store, spot delivery.

SODIUM BICARBONATE.—Refined recrystallised quality, £10 10s. per ton, ex quay or station. M.W. quality, 30s. per ton less. Manufacturers advise no change in price for next year.

SODIUM CARBONATE.—Soda Crystals, £5 to £5 5s. per ton, ex quay or station. Alkali, 58% £8 12s. 3d. per ton, ex quay or station.

SODIUM HYPOSULPHITE.—English makers' price about £10 per ton, ex station. Continental obtainable at about the same figure. Pea crystals quoted £15 per ton, ex store.

SODIUM NITRATE.—Refined 96/98% quality unchanged at about £13 5s. per ton, f.o.r. or f.o.b. U.K. port.

SODIUM NITRITE, 100%.—Quoted £26 10s. to £28 10s. per ton according to quantity, f.o.b. U.K. port.

SODIUM PRUSSIATE (YELLOW).—In little demand. For export price about 5½d. per lb., delivered f.o.b. U.K. port. Spot material at about the same figure, ex store.

SODIUM SULPHATE (SALTCAKE).—Price for home consumption £4 5s. per ton, carriage paid stations. Good export inquiry.

SODIUM SULPHIDE.—60/62% solid, £15 per ton, ex station. Broken, £1 per ton more. 51/34% Crystals, £9 7s. 6d. per ton, ex station.

SULPHUR.—Flowers, £10 per ton; roll, £9 per ton; rock, £9 per ton; ground, £8 per ton. Prices nominal.

TIN CRYSTALS.—Unchanged at 1s. 3¾d. per lb., f.o.b. U.K. port, or delivered.

ZINC CHLORIDE, 98/100%.—Moderate export inquiry now quoted £25 per ton, f.o.b. U.K. port.

NOTE.—The above prices are for bulk business, and are not to be taken as applicable to small parcels.

Coal Tar Intermediates and Wood Distillation Products

ANILINE OIL.—Export inquiry. Price lower at 9¾d. lb., f.o.b.

BETA NAPHTHOL.—Fair home demand. Price 1s. 1d. lb., delivered.

DIMETHYLANILINE.—Some home demand. Price 2s. 4d. to 2s. 5d. lb., delivered.

META NITRO BENZO SULPHONIC ACID.—Home inquiry. Price 2s. lb., delivered.

ORTHO TOLUIDINE.—Small export inquiry. Price 11d. lb., f.o.b., drums included.

PARANITRANILINE.—Good home inquiries. Price 2s. 5d. lb., delivered.

PARA TOLUIDINE.—Export inquiry. Price 4s. 6d. lb., f.o.b.

PURE TOLUOL.—Price 1s. 10½d. gallon, ex works.

XYLOL, COMMERCIAL.—Price remains firm at about 2s. 3d. gallon at makers' works.

Company News

THE NIGER CO., LTD.—The transfer books of the company's 5 per cent. debenture stock are closed until January 2.

THE HUELVA COPPER AND SULPHUR MINES, LTD.—The dividend of 8d. per share declared at the general meeting on December 4 will be payable on Thursday, January 10, to all shareholders registered on the books of the company on December 22.

THE BROKEN HILL PROPRIETARY CO., LTD.—It is announced that coupon No. 19 of the 6 per cent. debentures will be paid on and after Tuesday, January 1, at the Commonwealth Bank of Australia, 36–41, New Broad Street, London. Coupons must be left at the Bank three clear days previous to payment for examination.

BRITISH MOTOR SPIRIT CO., LTD. Presiding at the annual meeting of the company in London yesterday, Mr. Francis Daniell said that the depression in the oil industry which commenced nearly three years ago had continued up to the present time, and this year would long be remembered as one of great disaster for both oil producers and refiners. The daily average production in the United States rose from 1,500,000 barrels in 1922 to 2,400,000 barrels. This substantial increase in production was followed by successive cuts in the price of crude oils, which were followed by the most drastic check on over production. The worst of the depression in the industry, it was believed, had been passed. Despite the phenomenal increase in production consumption had not lagged far behind. Demand would inevitably increase still further, and if production fell, as it was expected to do, crude oil prices would improve.

LOW TEMPERATURE CARBONISATION, LTD.—The report for the period ended July 31 last states the commercial success of carbonising coal at low temperature has now been definitely established as a result of operating the Barnsley Plant on a commercial scale for the past two years. During this period these works have been producing the high-grade smokeless fuel "Coalite." To cope with the sales contracts, the works at Barnsley are being enlarged to produce 150,000 tons of "Coalite" per annum. The directors have been able to complete the necessary financial arrangements on satisfactory terms for this further extension, and also for the erection of similar plants in Staffordshire and other coal-producing counties. Messrs. Kerr, Stuart, and Co., Ltd., are assisting in the finance of this development. As a result of these developments, the company has now entered the profit-earning stage.

KAYE'S RUBBER LATEX PROCESS.—The report to October 31 last states that a considerable number of patents have been granted in addition to those taken over by the company at the time of incorporation, and the company now owns a comprehensive number of patents in a wide range of countries. Owing to the very unsettled state of Europe throughout the period under review, no sale of any of the foreign patents has yet taken place. Apart from the company's activities on the commercial side, important experimental work has been carried on by Mr. Kaye during the year with the object of testing certain extended developments of the Kaye process which may have far-reaching effects. With this object in view a small mill was rented and requisite machinery installed. The directors have kept expenditure on this experimental work within very moderate limits, but they consider that the results already achieved indicate the possibility of this fresh development of the company's activities proving of great importance. In view of the small amount of working capital available, every effort has been made to keep down expenditure. No payments have been made up to the present either to the general manager or for office accommodation and secretarial services, and no directors' fees have been drawn, with the exception of one small item of £33.

The Estimation of Hydrosulphite

A Rapid Volumetric Method

BROTHERTON AND CO., LTD., of Leeds, have perfected a simple method for estimating the purity of sodium hydrosulphite (Hydros), which is described in a leaflet issued by the firm and distributed to those interested on request. The great advantage of the method is that the results are not affected by oxygen in the water used in the analysis. It must not be used for analysing hydrosulphite containing decomposition products or soda ash.

Theory of the Process

A mixture of hydrogen iodide and hydrogen iodate in solution decomposes at once, giving free iodine :—

$$HIO_3+5HI=3I_2+3H_2O.$$

A mixture of potassium iodide and iodate can, therefore, be used to measure the hydrion of the bisulphite formed when Hydros oxidises potassium iodate :—

$$3Na_2S_2O_4+KIO_3+3H_2O=KI+6NaHSO_3.$$

$$6NaHSO_3+KIO_3+5KI=3I_2+3H_2O+3Na_2SO_3+3K_2SO_3.$$

The sulphite formed in the reactions above is oxidised by the free iodine :—

$$3Na_2SO_3+3K_2SO_3+6H_2O+6I_2=3Na_2SO_4+3K_2SO_4+12HI.$$

The hydrogen iodide, however, reacts with more of the iodide-iodate mixture and liberates a further six molecules of free iodine, so that the oxidation of the sulphites may be ignored :—

$$12HI+2KIO_3=2KI+6I_2+6H_2O.$$

The effect of Hydros on a mixture of potassium iodate and iodide is, therefore :—

$$3Na_2S_2O_4+4KIO_3+2KI=3I_2+3Na_2SO_4+3K_2SO_4.$$

The Hydros liberates its equivalent of iodine, and this iodine is measured by titration with standard thiosulphate.

Analytical Details

A litre flask is about half filled with water, and 6 gms. of potassium iodate, together with 10 gms. of potassium iodide, are added and dissolved. These quantities are approximate, but more rather than less should be used. 300 ccs. of N/10 thiosulphate is added from a pipette, and the flask filled to within about 50 ccs. of the mark. About 2 gms. of Hydros are accurately weighed in a weighing bottle, and poured into the flask through a perfectly dry funnel with a short wide neck. The flask is first shaken so as to impart a whirling motion to the liquid, then the flask and funnel are inclined to meet the weighing bottle, so that when the latter is completely inverted the funnel seals its mouth. This prevents the loss of any fine particles of Hydros in the form of a cloud. The flask is then filled up to the mark, stoppered and shaken till the Hydros is dissolved. The empty weighing bottle is re-weighed, and the weight of the Hydros is determined by difference.

The excess of thiosulphate is measured by titration (100 ccs. at a time), with standard N/10 iodine.

It is essential that in the weighing the Hydros be transferred from the sample bottle to the weighing bottle with a spatula, and not poured from one to the other. In the latter case a partial separation of the salt, generally used as a diluent, occurs, and the results are always too low, often by several units per cent.

The following example will illustrate the method of calculating the results :—

Weight of Hydros taken = 2·0136 gms.

Mean titration = 7·24 ccs.

N/10 iodine used to titrate complete litre = 10 × 7·24 = 72·4 ccs.

∴ N/10 thiosulphate left after dissolving Hydros = 72·4 ccs.

∴ N/10 thiosulphate absorbed in Hydros reaction = (300 − 72·4) = 227·6 ccs.

Molecular weight of Hydros = 174.

$$\therefore \text{Percentage of Hydros} = \frac{174}{2} \times \frac{227{\cdot}6 \times 100}{10{,}000 \times 2{\cdot}0136} = 98{\cdot}34\%$$

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

County Court Judgments

[*NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.*]

PETROLEUM PRODUCTS, LTD., 69, Great George Street, Liverpool, pomade manufacturers. (C.C., 29/12/23.) £14 14s. November 15.

Mortgages and Charges

[*NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

BROOKSBANK (E.) AND CO., LTD., Manchester, soap makers. (M., 29/12/23.) Registered December 11, debenture to bank; charged on freehold, leasehold and copyhold property of the company (except Trafford Park Oil and Stearine Works), also general charge. *Nil. December 12, 1922.

PRICE (A. S.) AND CO., LTD., Blackheath (Staffs.), chemists. (M., 29/12/23.) Registered December 10, £12,000 (not ex.) charge, to bank; charged on properties at Blackheath. *Nil. June 29, 1923.

ROGERSON (M.) AND SON, LTD., Bradford, chemists. (M., 29/12/23.) Registered December 15, mortgage securing £6,000 and further advances, to Building Society; charged on 8, Darley Street, Bradford. *——. September 12, 1922.

London Gazette

Partnership Dissolved

SHEFFIELD BOILER FLUID CO. (William Henry HITCH and James RILEY), boiler composition manufacturers, 20, Clyde Road, and Queens Road, Sheffield, by mutual consent as from November 23, 1923. Debts received and paid by J. Riley, who will continue the business.

New Companies Registered

JOHN CORBISHLEY AND SONS, LTD., 188, North Road, Preston. Manufacturers of, agents for, and dealers in colours, paints, pigments, varnishes, oils, dyes, etc. Nominal capital, £3,000 in £1 shares.

ELECTRIC CONDUCTORS AND COLOURS, LTD., 19/21, Moorgate, London, E.C.2. Chemists, druggists, drysalters, oil and colour men, manufacturers of and dealer in oils, paints, pigments and varnishes, etc. Nominal capital, £3,000 in £1 shares.

GENERAL AUTOMATIC MACHINES CO., LTD. Manufacturers of and dealers in perfumes, disinfectants, liquid and other fuels, etc. Nom. cap., £1,000 in £1 shares. A director: M. B. Sandy, 1, Brigstock Terrace, Ryde, I. of W.

H.T. DRUG CO., LTD., 35, New Lowther Street, Whitehaven, Cumberland. Chemists, pharmacists, manufacturers of and dealers in drugs, etc. Nominal capital, £1,500 in £1 shares.

MOORHEAD AND PARTNERS, LTD., Dunster House, Mark Lane, London, E.C. Dealers in chemicals (heavy and fine), manures, and dyes; chemical manufacturers and agents, etc. Nominal capital, £2,500 in £1 shares.

NEW CHESHIRE SALT WORKS, LTD., Wincham Lane, Wincham, nr. Northwich. To acquire the undertaking of Alfred Stubbs, trading as the New Cheshire Salt Works. Nominal capital, £15,000 in £1 shares.

PURE CHEMICALS CO., LTD., Bath Vale Works, Buglawton, Cheshire. Wholesale or retail chem. manufacturers, chemists, druggists, manufacturers of and dealers in chemical products, salts, acids, alkalis, drugs, etc. Nominal capital, £3,000 in £1 shares.

Tariff Changes

INDIA.—"Carbo limo" has been exempted from payment of import duty.

BULGARIA.—The free import of artificial fertilisers is now permitted provided a certificate is obtained from the Bulgarian Ministry of Agriculture certifying the nature of the fertilisers.

GERMANY.—The following goods may now be exported without licence:—

China clay (kaolin), whether calcined, ground, washed or not; Polishing or cleaning lime (Vienna lime), raw, ground or washed; Quartz, quartz sand; flints; Gypsum (sulphate of lime); gypsum superphosphate.

Portland and Roman cement, puzzolana cement, magnesia cement, slag cement and the like, with or without admixture of colouring or other materials, unground, ground or crushed.

Ferrocyanide scale, liquid or dried.

Soda, natural and artificial, crude, crystallised (soda salt), calcined or refined; bleaching soda; scale preventives containing soda.

Bicarbonate of soda.

Caustic soda, solid or liquid.

Artificial ice stone (cryolith, sodium aluminium fluoride); hydroxide of alumina.

Acetate and pyrolignite of lime.

Artificial silk, not twisted or twisted once or twice, undyed or dyed (even dyed white).

The following articles have been added to the list, and are now subject to export licence:—

Lead, brass, and other metal ash not elsewhere specified in the Tariff.

Radium and mesothorium; salts of radium and mesothorium, and radium preparations.

JAPAN.—It is announced that the recent suspension of various Customs duties is also applicable to Korea, as from September 17 last. A scheme for refunds of overcharged duties has been issued by the Governor-General of Korea.

NORWAY.—H.M. Minister at Christiania reports by telegraph that, as from December 5, Customs duties are to be paid in kroner at the gold rate of exchange. A "multiplier" (based on dollar exchange) is to be applied to the Tariff rates of duty, in order to determine the sum payable as duty. This "multiplier" is to be fixed each month by the Ministry of Finance, and is fixed for the present month (December) at 1·79. Goods subject to *ad valorem* duties are not affected by the present measure.

POLAND.—The following items are extracted from the schedule of percentage reductions in the Polish Customs duties on certain articles, provided for by the Franco-Polish Treaty in respect of French goods, and to be extended to similar goods of United Kingdom origin on the coming into force of the Anglo-Polish Commercial Treaty:—

Article.	Percentage Reduction in Duty.
Tartar (cream of tartar), tartrate of lime, semi-refined citrate of lime (not in powder), of natural colour....	35
Caffeine, quinine, strychnine, morphine, codeine, veratrine, atropine, cocaine, and their salts.....	40
Acetanilide	40
Antipyrin, salipyrin, phenacetin, sulphonal, salol, guaiacol, carbonate of guaiacol and of creosote, pepsine, peptone and santonin	30
Artificial sweetening substances whose sweetening power exceeds that of cane sugar	50
Artificial silk yarns	30

SPAIN.—A decree which came into force on December 1 prohibits the payment of gratuities to Customs officials and provides for special fees for Customs service.

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INDEX TO ADVERTISERS—*Continued*

FOR CLASSIFIED INDEX TO TRADES SEE PAGES xxxvi & xxxvii

NOTICE TO READERS ABROAD

The following agents are authorised to receive subscriptions for this Journal from readers desirous of having it delivered to them regularly, and all orders should be accompanied by remittances at the following rates:
6 months, 15s. 12 months, 30s.

AUSTRALIA.	Gordon and Gotch, Ltd., Adelaide, Brisbane, Melbourne, Perth, Sydney; G. Jervis Manton, 430, Little Collins Street, Melbourne; The Commonwealth Magazine Agency, 317, Collins Street, Melbourne; The Tait Book Co., 90, William Street, Melbourne.
AUSTRIA.	At the offices of "The European Commercial," Hohenstaufengasse 7, Vienna I.
ARGENTINE.	Agence Générale de Librairie, 1571, Calle Rivadavia, Buenos Aires.
BELGIUM.	Agence Dechenne, 20, Rue de Persil, Brussels; British Chamber of Commerce in Belgium (Inc.), 2, Rue de la Bourse, Brussels; W. H. Smith and Son, 78-80, Rue du Marché-aux-Herbes, Brussels.
CANARY IS.	Pedro Torón Garcia, Buenos Aires, 9, Las Palmas.
CUBA.	Universal Trading Co., Habana.
CYPRUS.	George Sons and Co., P.O. Box No. 6, Nicosia.
DENMARK.	B.T's Boghandel, Raadhuspladsen 55, Copenhagen.
EGYPT.	Agence Générale Egyptienne de Librairie, 42, Place de l'Opéra, Cairo.
FED. MALAY STATES.	L. H. Hoh and Co., Kuala Lumpur, Selangor.
FRANCE.	Messageries Hachette, 111, Rue Réaumur, Paris; Brentano's, 37, Avenue de l'Opéra, Paris; W. H. Smith and Son, 248, Rue de Rivoli, Paris.
GERMANY.	Technische Verlagsanstalt G.M.B.H., Leipzigerstrasse, 101-2, Berlin, W.8.
HOLLAND.	Firma voorheen H. W. Dusault, 25a, Botersloot, Rotterdam; Jacs. G. Robbers, Singel 151-153, Amsterdam; Templeton and Co., Ltd., 55, Heerengracht, Amsterdam.
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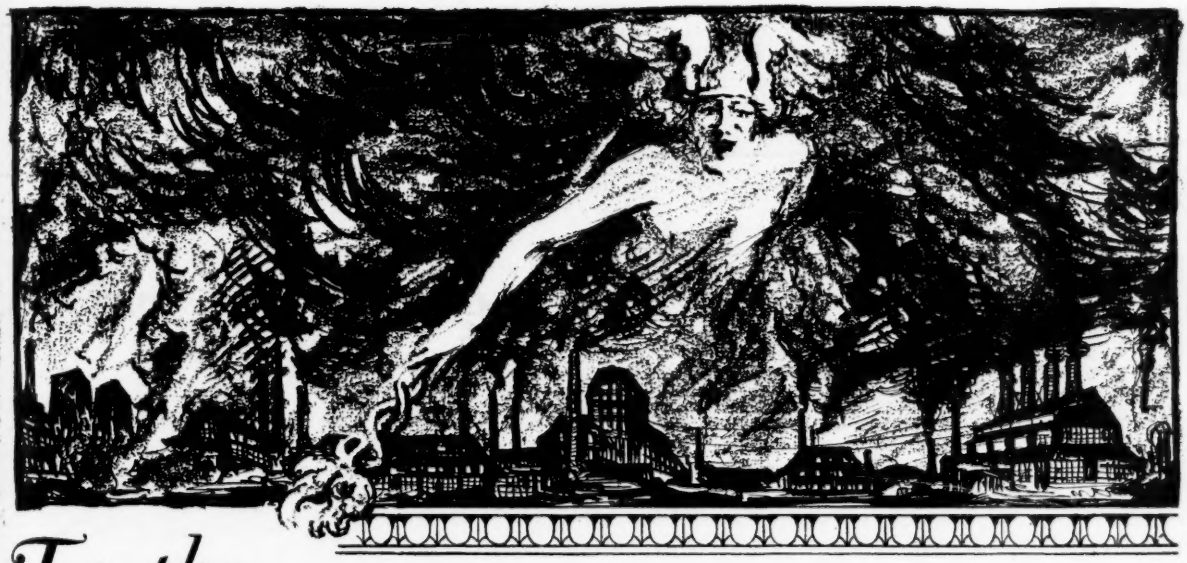

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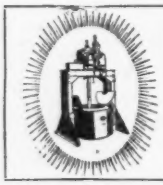

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The Chemical Age

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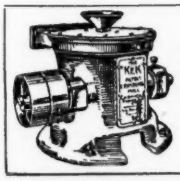

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The China Clay Trade Review

The Official Organ of the China Clay Industry and the only Journal specially devoted to its interests. Published in the third issue of "The Chemical Age" each month.

All Editorial communications should be addressed to the Editor, "The China Clay Trade Review," Benn Brothers, Ltd., 8, Bouverie Street, London, E.C.4. All communications relating to Advertisements, Subscriptions, and other business should be sent to the Manager, "The China Clay Trade Review," at the same address. Telegrams—"Allangas, Fleet, London." Telephone—City 9852 (6 lines).

Contents

The Best Half-Year since 1914

WITH the returns of the deliveries of China Clay in June before, us it is possible to review the progress of trade for the first six months of the year in comparison with corresponding periods. The figures of the half-year are extremely gratifying for they record the fact that the first half-year of 1923 has been the best in the history of the industry for the past ten years, the total having been 432,257 tons. This compares with one half-yearly average of 370,000 tons in 1922, with 150,000 tons in the slump year of 1921, and with 450,000 tons in the good pre-war years. It will, therefore, be readily seen that the revival that has been experienced in the China Clay industry since 1921 has been very substantial and that it has been of so progressive a character as to justify the belief that it will be permanent. If the second half of the year continues as well as the first half has done the total will approximate to an average pre-war year, for the total trade done has only once approximated to a million tons and that was in the trade "boom" year of 1912.

In some respects the recovery in the China Clay trade is remarkable, especially this year, when the conditions have been very much more difficult to China Clay overseas trade than they were in 1922. Take the American market. In this, the most important export outlet the English China Clay producers have, there came into force a new tariff against China Clay representing double what it had been for many years. The incidence of the doubled tariff and any influence it may have had in inducing the more extended use of American Domestic Clays has coincided with a trade "boom" in the States, the demands of which have given an impetus to the China Clay trade in the first half of this year. Those demands have been so persistent and immediately imperative as to overcome the detriment of freights, which were the outcome of the situation on the Ruhr and the diversion of steamers from Clay to coal traffic. Therefore the China Clay trade, viewed in the light of the American market alone, has shown a degree of progress that is noteworthy, having regard to the increased American tariff and the high freight they have ruled.

If we examine the European trade position, the volume of China Clay business done is very encouraging, when we remember what a deadening effect the situation on the Ruhr has had during the six months under review. The further we get away from the Rhineland zone the better are the European markets for China Clay.

Our home markets for China Clay have had a large share in the revival of the last six months. The paper mills, cotton mills, chemical works, and potteries have all in varying degrees been placing fairly substantial orders. There are indications that home paper mills are paying more attention to the production of cheap papers.

Our review of six months' trade reveals the fact that Central Europe, of all our overseas markets, remains the black spot. Given the restoration of these markets the English China Clay industry would indeed become prosperous beyond even the zenith of its pre-war prosperity, for since then the markets for China Clay have expanded to an extent which, as an analysis shows, has almost reached the pre-war level even with Central Europe left out of account.

The Possibilities of Oil Fuel

THE illustrated account published in our last issue of the conversion of a coal-burning kiln to that of oil has aroused considerable interest in China Clay circles, especially its adaptability to existing kilns. The drying of clay is, next to labour, the heaviest cost on the production side, and one which has exercised the thought and attention of producers for many years. The fact that this particular oil-burning kiln has over a period of six months shown a considerable saving over coal is, perhaps, the item of greater interest to producers, but the cleanliness and absence of smoke from the chimney stacks is also a consideration.

Unlike many processes for the drying of China Clay, the adaptation of oil fuel to the kiln is not an expensive matter. The whole cost, we understand, of the first one tried was approximately £500. That the system has been successful there can be no doubt, and opens out great possibilities for the future. With coal at its present price, any method of drying which can really show a saving that is genuine is a matter of deep interest to all concerned. We say "a saving that is genuine," because with so many methods offered to the trade it has been found that where a saving has been effected in one direction this has, as often as not, been nullified by extra labour costs or expenses which more than counterbalance the apparent saving. Oil fuel, for drying of China Clay, we believe has come to stay, and we shall watch with keen interest the development of this process.

Rubber Latex

IN our correspondence column we publish a letter from a firm who have sent us a sample of China Clay coated with rubber latex. They claim great simplicity for their process of manufacture. The British paper industry, equally with the China Clay producer, is interested in the discovery and utility of latex in producing a stronger and better paper. Many paper mills have made practical tests and find a decided improvement in the paper; others find that by its use they can cheapen production. China Clay coated with latex will undoubtedly play a useful part in the paper mills of the future.

The Chemistry of Colloidal China Clay

By Alfred B. Searle

This is the fifth instalment of the series of articles commenced in our March issue, dealing with colloidal clay in general and colloidal China Clay in particular.

VI.

Clay Precipitates and Gels

In a previous section it has been shown that a clay soil is usually very sensitive to the addition of any other substances, and that it is very easily precipitated in the form of flocculent or gelatinous masses which rapidly settle. Silicic acid behaves very similarly, and under favourable conditions the gelatinous precipitate, together with the whole of the liquid present, sets to a soft but readily recognisable jelly.

Clay jellies are seldom formed; clay usually produces a mass of gelatinous flocks, which settle to the bottom of the vessel with a layer of supernatant water above them. If, however, the clay sol is sufficiently concentrated and the precipitation is skilfully effected, the whole mass forms a true jelly. To prevent confusion, the word *gel* is applied both to the flocculent precipitate and to the jelly, but not to a dense, sandy or obviously non-colloidal precipitate. A "gel" is really a solid or semi-solid colloid.

The conversion of a colloidal sol into a gel is known variously as "precipitation," "coagulation," "flocculation," and "agglomeration."

The precipitates obtained from colloidal sols may be:

(i.) *crystalline*, without any colloidal characteristics.

(ii.) *sandy* or dense (as opposed to a flocculent or spongy precipitate), and usually formed by aglomeration of a flocculent precipitate.

(iii.) *flocculent*—a light, spongy precipitate which does not settle readily, and usually includes a large proportion of water. Many gels are of this type.

(iv.) *gelatinous, jelly-like* or viscous, as aluminium hydroxide, and differing from a true jelly in showing a distinct liquid phase.

(v.) *curdy*, or resembling the curds produced by adding an acid to milk, and

(vi.) *liquid*, as in an emulsion.

The size of the precipitated particles depends on the conditions under which they are formed. If produced from highly concentrated solutions the precipitates are usually flocculent or crystalline. If gelatin or some other substance which is strongly adsorbed by the precipitate is present before and during precipitation, the precipitate will be in a finely divided state. Slow precipitation, especially under favourable conditions of temperature, usually favours the formation of a coarsely crystalline precipitate. The presence of ions of a particular type may also affect the nature of the precipitate.

Colloidal gels are always viscous, but very little is yet known as to their constitution and structure, though it is generally agreed that they have a spongy or honeycomb structure. When first formed they appear to consist of minute drops which gradually coalesce, though why substances like alumina, clay, and silica should behave in this manner is not known.

The nature and properties of clay gels will be better understood if the methods of preparing them are first considered.

VII.

Preparation of Clay Gels

Clay gels are invariably prepared from clay sols by a process of precipitation or flocculation. The sol, prepared as explained in Section IV., by a process of peptization or disintegration, is placed in a suitable vessel and to it is added a suitable quantity of the flocculating or precipitating agent. It will have been seen from the statements made in a previous section that a large number of such agents are available, and that they may act in several different ways. The agents most usually employed are:

(*a.*) An acid having an easily adsorbed ion of the opposite electric sign to the clay. Almost any acid may be used for this purpose, but the desirability of avoiding certain ones if the clay is to be used later for chemical purposes must be considered.

(*b.*) An acid salt corresponding to (*a.*), but possessing some minor advantage, either as regards cost or with respect to the future use of the clay.

(*c*) A salt having the necessarily easy-adsorbed ions, such as alum, which is often used on account of its cheapness and convenience, rather than because it is any better than either of the foregoing classes of precipitant. In some cases the use of alum is advantageous because, when decomposed with formation of aluminium hydroxide, it produces a very voluminous precipitate, which readily enmeshes fine particles of sewage, etc. In this way, alum acts as a good clarifying agent.

(*d.*) A colloid of opposite sign to the clay—*e.g.*, ferric hydroxide or aluminium hydroxide. These are usually costly, and so are only used where it is desired to precipitate the clay in a form in which the added colloid will be of use. If it is desired to increase the alumina content of a clay gel, alumina or an equivalent aluminium salt may be used.

(*e.*) An electric current may be used to decompose any salt and to liberate readily-adsorbed positive ions which will then produce the desired flocculation.

The flocculating agent must be added slowly and in suitable quantity, the sol being stirred during the addition and preferably for some time afterwards. A slight excess of the agent is necessary in order to ensure the complete precipitation of the clay, but a large excess should be avoided, as it adversely affects the physical properties of the precipitate and tends to diminish its absorbing power.

If a colloidal sol is of complex composition it may be fractionally precipitated by carefully-adjusted quantities of the precipitating agent, and by this means one of the colloids present may be separated before the others. Thus, with very careful addition of acid the greater part of the "clay" may be precipitated from a mixture of clay and silica-sols, and a more desirable product thereby obtained. Fractional precipitation is well known in ordinary chemical operations, and its use in connection with sols involves no novelty.

The nature of the gel or precipitate is greatly affected by the concentration of the sol from which it is produced by the temperature rate at which the precipitate is added, and even by the quantity of sol used at a time. Consequently, all these factors require careful attention in the preparation of a colloidal gel. It is also obvious that if a sol contains any other substances in suspension—such as minute flakes of mica which are enmeshed in the clay soil—these will be carried down into the clay gel unless they are removed by a process of fractional precipitation.

The precipitated gel must be allowed to settle—unless the whole of the material is to be subjected to centrifugal action—after which the gel may be separated by running off the supernatant liquid. The sediment is then further drained in a filter press, or it may be dried by heat or in any other appropriate manner.

The greatest care is needed not to overheat the product and thereby convert it into an irreversible colloid which is largely devoid of colloidal properties, and is practically inert. Very slight overheating will have this effect, and it is probably correct to say that no clay gel which has been completely dried can be completely reconverted into the sol form. This is a matter of great importance in some industries in which the value of the clay lies in its colloidal nature; an inert or merely amorphous mass being possibly useful as a "filler," but devoid of the adsorbtive properties which make colloidal clay so useful and valuable.

Several examples of "colloidal clay" examined by the author were badly spoiled by overheating during drying, and were consequently of small value for the purpose for which they were intended.

A skilfully prepared clay gel will be completely reconverted into the sol form by any of the processes mentioned in Section IV.; a badly prepared gel, on the contrary, will leave a large proportion of "sediment," which cannot, by any simple means, be dispersed sufficiently for it to remain permanently in suspension.

VIII.

Properties of China Clay Gels

China Clay gels have not been studied in sufficient detail for their nature to be well understood, but silica jellies have been very fully investigated, chiefly by van Bemmelen. Silica jelly may contain 300 mols of water to one of silica. If broken, the pieces will reunite again. If only 30–40 mols of water are present the jelly will stand alone, with 20 mols it is stiff, with 10 mols it is brittle, and with 6 mols of water it can be ground to powder.

Clay gels are seldom clear or transparent because they usually contain a considerable quantity of occluded air or vapour. They contain also a large proportion of adsorbed water, to which they owe their large volume. When allowed to dry this water evaporates and the clay gels shrink, and if the drying is too rapid they may crack badly. The water may be removed (i.) by exposure to air, (ii.) by keeping the gel in a vessel which also contains sulphuric acid or other dehydrant, and (iii.) by heating. The drying in each commences at the surface of the gel and proceeds at a rate which depends partly on the nature of the atmosphere and partly on the capillary structure of the gel. The liquid is drawn from the centre of the gel to its surface by capillary action due to the honeycomb structure of the gel. As the drying proceeds the gel shrinks until the remaining particles form so dense a mass that further shrinkage at that temperature is impossible. Any water still remaining in the pores of the material then escapes without there being any further change in the volume of the gel.

If the gel is completely dried it is very difficult to make it absorb water in sufficient quantity to restore it to its original form. In this respect it differs from gelatin, in which the change is readily reversible.

When China Clay gel is heated rapidly to temperatures above the boiling point of water it shrinks, cracks and eventually sinters, forming a hard, stony mass and loses most of its colloidal properties.

The amount of swelling which a cautiously dried clay undergoes when soaked in water has not been accurately measured. Various results obtained by the author from gels made of China Clay from different sources show such variations as to suggest some difference in the nature of the original clays.

The amount of heat involved when a clay gel is soaked in water and allowed to swell must be measurable, but no data on this subject have yet been published.

The constitution of a clay gel is probably best represented by a minute porous ball composed of long lath-like crystals, which are so tangled as to retain the globular shape of the mass. This mass has clearly a very large surface which can retain a relatively large amount of adherent water, not merely in its spherical surface, but also in the surface of the individual crystals. As the amount of water so held increases, the clay crystals may separate, forming more platelite or laminated masses which would account for some of the properties possessed by China Clay. The force of molecular attraction between the clay crystals and water appears to be so great as to enable them to form a core which is surrounded by a relatively thick film of water, so that the two form a series of globules which possess the properties of a colloidal gel. It appears probable that a constitution of this kind is the cause of China Clay behaving partly as an emulsoid and partly as a solid colloid. The nature of the colloidal film (if such a real film exists) has never been ascertained; it is probably an imaginary film due to the effect of surface tension, which makes drops of water appear to possess a similar structure.

Owing to the peculiar structure of gels they can contain relatively large proportions of water even when apparently dry. This easily leads investigators to erroneous conclusions as to the formation of definite compounds (hydroxides) which probably do not exist.

The presence of salts in carefully-washed clay precipitates is another characteristic of colloidal gels. The more strongly the salt or adsorbed ion is adsorbed the more difficult will it be to remove it by washing, and when such removal does occur it will usually result in the clay or other gel being reconverted into the sol state. The only way to avoid this change is to allow the gel to stand for several days prior to washing it; the washing may then be performed much more satisfactorily though not necessarily completely.

Many properties of China Clay sols are also those of commercial China Clay, and need not be considered in great detail. In this respect a good commercial quality of China Clay may be regarded as a crude gel. The extent of the non-colloidal or inert material present may be ascertained by converting such clay into the sol state, separating the sol carefully and collecting and weighing the unconvertible material.

The properties common to commercial China Clay and to the gel made therefrom are—

(i.) *Hygroscopiscity*, or power of adsorbing water, which is very marked, especially in a well-made gel,

(ii.) *Plasticity*,

(iii.) *Binding power*, which has previously been considered,

(iv.) *Immiscibility*, which is limited with respect to some other gels and even to some plastic clays. According to Rohland, this is due to clay gels being insoluble in water and incapable of adsorbing some other colloids,

(v.) *Semi-permeability* to colloidal sols and to some crystalloids.

According to Rohland, plastic clays will allow ferric chloride and sugar (crystalloids) to diffuse, but not tannin (colloid). In emulsions of oil and water, plastic clays permit the (crystalloid) water to pass, but not the (colloid) oil. In alcoholic solutions of fat, such clays permit the alcohol to pass, but not the fat. In aqueous rubber 'solutions,' plastic clays prevent the rubber from diffusing, and in albumen solutions the albumen is retained, both rubber and albumen being typical colloids. The diffusibility or speed at which the substances dialyse through the membrane depends on their nature. Thus water, which is a crystalloid, and electrolytes—*e.g.*, salts dissolved in it, diffuse rapidly, but colloids, such as ferric hydrate, hydrated silica, hydrated alumina, and most products of organic life, such as starch, vegetable oils, and gelatin, are either indiffusible or pass through with extreme slowness. Colours, on account of their complex composition, play a special part; they are retained by plastic clays, though these colours are crystalloid and not colloid. Berlin blue, potassium ferricyanide, aniline blue, sulphated triphenyl, rosaniline, aniline red, carmine, malachite green, fluorescin, aurin and other animal, vegetable and tar colours, cannot diffuse through clay, and this in spite of their crystalloid nature.

The explanation of semi-permeable membranes most widely accepted at the present time is that of selective solubility, suggested by L'Hermite. The membrane is permeable to those substances which dissolve in it, but not to others.

As the semi-permeability of clays appears to be connected with the plasticity, any treatment which will increase the latter should increase the former. Rohland has found this to be the case with some lean clays he has examined. Some of the phenomena occur whenever plastic clay is mixed with solutions, as the particles allow the crystalloids in the latter to pass through them, but retain the colloids on their surface. In this way the adsorption of crystallised matter as well as colloidal matter occurs; but as the particles of clay are so minute the effects are scarcely distinguishable, and clays appear to be capable of absorbing both colloidal and crystalloidal substances.

The permeability of raw clays has been studied by Spring, who found that when such clays are confined so that they cannot expand, they will only absorb enough water to fill the pores. The amount absorbed varies from 3 per cent. with some fireclays to 25 per cent, with some sandy loams. When not confined in this manner, the extent to which the water can permeate a clay is dependent on the amount of non-plastic material it contains and increases when sand or grog is added. The permeability of a fired clay is an important characteristic, and is described later.

The more permeable a clay the more easily it can be dried and heated without damage, large pores being preferable to small ones.

Wet clay in the form of a stiff-plastic paste is generally considered to be extremely impermeable, but, as already mentioned, this is only a relative property, as such a mass of clay, if left in water, will in time fall to pieces. Clay which has been suspended in water and allowed to settle is usually quite permeable, as are many natural clay deposits. It is only when the material has been "worked" or "pugged" that it becomes impermeable.

(vii.) The *sectility*, or capability of being easily cut, and the glossy appearance of the cut surface are characteristic and the converse of the property of (viii.)—*adhesiveness* when two pieces are brought into direct contact is almost equally so. Absolute contact is essential, as otherwise a superficial film of air will completely prevent adhesion.

Finally, (ix.) the *effect of age* on China Clay paste and on colloidal gels generally is very similar, provided the conditions are favourable to each case.

The swollen gel produced on prolonged storage is very permeable in water, and its structure may be compared to a series of solid grains wholly surrounded by liquid films which are not sufficiently thick to allow the particles to separate from each other or to flow appreciably. Such a structure has a powerful capillary action, and consequently it effects the distribution of the water through the mass in a most thoroughly efficient manner. This uniform distribution of the water largely—in conjunction with the coagulating and swelling of the colloidal matter—accounts for the increased ease with which an old clay paste can be manipulated. The water in freshly-pugged clay cannot be so uniformly distributed as when such a paste has been allowed to stand for several weeks, during which time the water is distributed through the mass by capillary attraction.

A much shorter storage of the clay paste, frequently in open sheds, the material being covered with wet sacking, is known as *souring*. Its effect is undoubtedly to increase the active as distinct from the dormant, plasticity of the clay, though there is a great variation in the extent to which this takes place. There is a widespread impression that souring is the result of bacteria or ferment-organisms, and some potters added sugar or honey to the clay to assist the fermentation, but, whilst this may account for some of the observed effects, the hydrolysing action of the water present in the mass on the clay, silica and iron hydroxide particles must not be overlooked. Rohland suggested that the fresh clay paste is slightly alkaline owing to the felspar, etc., present in the clay being hydrolysed and converted into the colloidal form. The acids produced by the decomposition of any organic matter also present neutralise the cations; and the excess of hydrogen ions produced coagulates the colloid matter, and correspondingly increases the plasticity of the clay. This explains why the old vinegar "tip" of bygone potters develops the plasticity. Previous to this, Seger had found that clays which remain alkaline do not increase in plasticity on storage, but do so if they are acidulated with acetic acid.

Ware made from a properly soured paste is less sensitive to sudden changes of temperature, can have thinner walls, does not break so easily, and is easier to produce, as the souring increases the plasticity of the paste.

Clay and Carborundum

Valuable Refractory in Combination

CARBORUNDUM is a refractory which is said by experts not to have received the attention it deserves. It is a comparatively expensive material, but its remarkable properties make it very desirable for some purposes in spite of its cost. In the *Journal of the American Ceramic Society*, Mr. F. Peters contributes an article on carborundum bricks. For good working conditions the amount of clay must suffice to cover the grains of carborundum. If the minimum amount of clay is to be used, the carborundum must be very coarse, and if the voids between the particles of carborundum are to be filled with a minimum amount of bond the carborundum must be very fine grained. Some intermediate size of grain of the carborundum would require a minimum amount of clay if each particle of carborundum were to be covered with clay, and at the same time the voids between the particles were to be filled. Still less clay would probably be needed for a mixture of several sizes of carborundum grains, the smaller sizes helping to fill up the voids. The proportion of clay required can be ascertained by adding sufficient water to carborundum to wet the surface of each particle and fill the voids, the quantity of water added being then a measure of the required volume of clay. The product of the volume required and the specific gravity of clay (2·55) gives the weight of clay required. Tensile strength increases rapidly at first with the percentage of carborundum, then remains practically constant, and afterwards falls off very rapidly. Maximum strength was found in the case of a certain fireclay to correspond with about 45 per cent. carborundum and in the case of certain ball clays with about 70 per cent. carborundum. The predicted life of a brick may be defined as that number which represents the total number of days the brick may be expected to give useful service, and this life is inversely proportional to the destructive action—that is, to the sum of all the destructive forces (slagging, compression, etc.).

No Trouble with Sufficient Clay

Whenever sufficient clay is added to carborundum to surround each particle with clay and to fill the voids, there will be no trouble experienced in pugging or moulding the mixture, whereas by the use of a smaller proportion of clay the trouble increases with reduction of the percentage of clay, and is commonly associated with the development of cleavage planes. This latter feature can only be eliminated by making the bricks under great pressure. Resistance to deformation at high temperatures increases with the percentage of carborundum. The resistance to spalling depends on the percentage of carborundum, the tensile strength, the co-efficient of expansion, and the thermal conductivity of the clay. Spalling is reduced as proportion of carborundum increases, but beyond a certain limit the spalling increases. Increased tensile strength in clay causes less spalling. Carborundum decreases the spalling action by increasing tensile strength, increasing thermal conductivity, and decreasing the co-efficient of expansion of the mixture. A formula is proposed by the author for the estimation of the life of the carborundum refractories, and this gave results in close agreement with actual experience. When subjected to crushing, the linear compression varies as the second power of the percentage of carborundum present.

High Tensile Strength Necessary

The general conclusions are that (*a*) there should be a maximum amount of coarse carborundum with a minimum of fines, but sufficient fines must be added to fill the voids of the preceding coarser sizes as far as practicable. (*b*) The percentage of clay to be added to the carborundum to fill the voids depends upon the ratio of the sizes of the carborundum particles. (*c*) Other things being equal, the tensile strength of any mixture of carborundum and clay is proportional to the bonding power of the clay. When different percentages of carborundum and clay are mixed together the tensile strength first increases rapidly with the percentage of carborundum, then remains practically constant with further increase up to a point, and finally it decreases very rapidly. The proper percentage of carborundum to use in any mixture to obtain the maximum tensile strength depends upon the physical characteristics of the clay. (*d*) When sufficient clay is added to carborundum to fill the voids and surround each particle of carborundum, there will be no trouble in pugging or moulding the mixture. When these conditions are not fulfilled, trouble arises and increases as the percentage of clay is diminished. (*e*) The linear compression varies as the second power of the percentage of carborundum present, so that where bricks have to withstand great pressures the percentage of carborundum should be as high as possible. (*f*) Carborundum will resist the action of most slags better under reducing than oxidising conditions. It will not resist slags high in iron, lead or lime, but will resist those high in silica. (*g*) The length of time a brick will resist spalling depends upon the percentage of carborundum in the brick, the tensile strength, coefficient of expansion, and thermal conductivity of the clay. (*h*) Each bond clay presents a different problem, and the proportions to use can only be determined by trial. (*i*) The formula shows that a good bond clay should have high tensile strength, high softening point, low coefficient of expansion, high thermal conductivity, and that a good body should have rigidity at high temperatures, low coefficients of expansion and high thermal conductivity. (*j*) Finally, if the refractories are to be used where the physical destructive forces (spalling, compression, abrasion, etc.) are great, and the chemical forces small, carborundum will make an excellent grog. If the slags which come in contact with the refractories are high in silica, carborundum may still be used. If the slags are high in iron, lead and lime, and occur in great amounts, then carborundum should not be used.

China Clay in Paint

(From an American Correspondent)

WHEN we use the terms China Clay or Kaolin, we refer only to the white earthy pigments of silica and alumina that are used in paints and colours. We pass by the species of earth known as pipe clay, potters' clay or fire clay, for which there is no use in paint making because of their colour or other special characteristics. While the general term for white clay is Kaolin, this name is used in our trade for the white clay mined in various parts of the United States, principally in Alabama and S. Carolina, but also in some Northern localities. This will answer many purposes in the line of paint manufacture, but where a really soft and very white material of this character is required, the imported article known as China Clay, mined and prepared for export at Cornwall, England, is preferred. Pigments equalling this clay are also found in other countries, especially Germany and France, but for commercial reasons hardly ever imported into this market. G. H. Hurst, in his work on "Painters' Colours, Oils and Varnishes," describes the origin and also the manufacture of China Clay as carried on at the clay works of Cornwall, so that it will be unnecessary to devote space to the subject here. All the white clays for use in paint must consist of silica and alumina with some combined water, otherwise they will not fulfil their function. The texture varies somewhat according to this composition, some being more unctuous than others. If silica were not present in the pigment it would have no tooth whatever and with oil produce a liverlike mixture. The China Clay that by chemical analysis approaches closest to the following composition may be considered best for general use in paint :—

Silica, 47 per cent. ..... SiO_2
Alumina, 39 per cent. ..... Al_2O_3
Water, 13 per cent. ..... H_2O

(allowing 1 per cent. for free moisture, magnesia, potash, iron).

The colour maker will, however, prefer the pigment entirely free from iron oxide. American Kaolin will vary somewhat from this analysis, generally consisting of more silica and showing appreciable fractions of 1 per cent. iron oxide and lime. Still fairly large quantities of the domestic article are being used in many special paints where light weight per gallon is desirable. When China Clay is imported it comes in large casks, two to the long ton, and the clay is in lump form, usually containing 6 to 10 per cent. moisture that has to be driven off before it can be bolted for the use of the paint maker, hence the price of bolted China Clay is so much in advance over the quotation of the importer. Enormous quantities of this clay are imported for industrial purposes, where it is used in the pulped form, and in that case the amount of moisture cuts a figure only as to its weight. The clay absorbs some moisture in transit and on being stored on the open wharves, hence the large percentages of water usually found

Tests and Use of China Clay

The pigment, home or imported, is classed as hydrated silicate of alumina and should therefore be insoluble in water, alkali or dilute acid solutions. It is decomposed, however, by long boiling with strong sulphuric acid, forming alumina sulphate in solution and a precipitate of silica. The finer the grade the more greasy the feel between the fingers, while American Kaolin always feels rougher though it may be perfectly free from grit. To test for fineness spread it mixed with turpentine on a strip of dry glass, treating a selected standard similarly. This test, by permitting the turps to evaporate, will also serve to test whiteness or absence of discoloration. Some China Clays or Kaolins are more opaque than others, and when the pigment is to be used as an extender for white paint, the most opaque should be selected, while when used for reducing colour that with less opacity is best, as it does not absorb so much of the colour, which is usually much higher in cost than the clay. A simple test will determine this. Weigh out 1 drachm of each clay to be compared, also for each sample of clay 3 Troy grains of ultramarine blue, and on a marble or glass slab mix the clay and blue with as many drops of oil as is necessary to make a rub-out, comparing all on a strip of glass, side by side, the clay that is coloured most deeply by the blue being the least opaque, because it does not resist colour as much as that which is more opaque. It this test is carried out accurately it will also show which of the clays requires most oil by noting the consistency of the rub-out.

China Clay is not used to the extent it deserves in paint making, because of its great oil absorption and becoming rather transparent when ground in oil. It should not really be classed as an adulterant for the reason that it does not pay to use it as such, as there is more oil required to mix it and grind it than is the case in grinding some of the pigments that are really adulterated. The average specific gravity of China Clay or Kaolin is 2·25, and a gallon of bolted or pulverised dry clay packed will not weigh over 6½ to 6¾ lb. It requires 30 lb. or nearly 4 gallons of linseed oil to mix 70 lb. dry China Clay to a stiff paste, while 55 lb. of oil and 45 lb. of clay will be about the right consistency to be spread with the brush. Wherever whiting is barred out as an extender for heavy pigments for the reason that the presence of carbonate of lime makes the paint subject to disintegration from contact with sulphur gases, or that the alkalinity of whiting affects the colour as in the case with Chinese or Prussian blues, China Clay or Kaolin will be the best pigment to replace it. It is really a better suspender for heavy pigments than the ordinary grades of whiting, and only its higher cost and its being so great an oil absorber are against its more extended use. Bolted English China Clay has also been offered to the trade under the name of English Kalsomine for use in tints with colours that are not alkali proof, such as blues, greens and reds. Many liquid fillers for soft woods, or in fact most of them, contain China Clay as the only pigment, while it has also been used as pigment for paste hardwood fillers along with some other white mineral substances or with starch. It is not so long since it was the custom to prepare the lower priced shade cloth by running muslin through a size prepared by cooking equal parts by weight of cheap starch and China Clay in water to a paste, colouring same with aniline colours, and running the muslin so filled or painted over three heated rollers of a calender, thus obtaining a fine and fairly well wearing finish on these low-priced shades.

Grit in Paper

IN the course of a paper recently read before the Royal Microscopical Society in London, Mr. James Strachan, of the Donside Paper Mills, Aberdeen, who has previously criticised the occurrence of grit in China Clay, said : All paper contains a small percentage of grit or sand. This is a subject that has not received the attention due to it, and it is one that can only be dealt with properly by the microscopist. The sources of this grit are numerous, and can only be traced up with the aid of a mineralogical microscope. A large proportion of the grit in printing papers may be traced to the China Clay used in loading, and, when excessive causes undue wear and tear of process blocks. I have found a small percentage of grit in a foreign paper specially made for wiping the front lens of oil immersion objectives. I so not advise the use of paper of any kind for cleaning photographic or other lenses.

Producers of China Clay consider that disparagement of China Clay on account of grit is a little overdone. Evidence of this has been forthcoming recently from Mr. J. M. Coon, the St. Austell authority on China Clays, who on subjecting samples of clay said by paper people to contain grit, were shown, on being subjected to microscopic tests, not to *contain grit at all.*

A St. Austell Man Honoured

MR. ANDREW PETERS was recently the recipient of a very handsome testimonial, presented by his colleagues in the Board of Education on the occasion of his retirement from the Civil Service on attaining the age of 60. The gifts consisted of an illuminated address accompanied by a very ornate library timepiece, and the presentation was made at the Victoria and Albert Museum, with which Institution Mr. Peters has been connected for well over 30 years. Mr. Peters, who is a native of St. Austell—and proud of it—is the elder son of the late Mr. Woodman Peters, and, like the other members of the family, has a material interest in the China Clay industry in connection with the firm of Parkyn and Peters. Mr. Peters entered the Civil Service by open competition in the early 'eighties and has had quite a successful official career, ending in his assimilation to the newly-established Executive Class of the Service from which he retired on the 31st of last month.

China Clay Notes and News

Oil in Somerset

THE following account of the discovery of oil in so near a county as Somerset will interest China Clay producers, in view of the article we published last month on the new oil fuel kiln, established successfully at Par.

It will probably occasion surprise to many to learn that West Somerset contains probably the richest oil-bearing shales in the United Kingdom.

Not only do they contain petroleum in considerable quantities, but they are also rich in lubricating oils of the finest quality. For over two years these shales have been under the notice of Dr. Forbes Leslie, an eminent geologist, and one of the greatest living authorities in the oil world. Analysis made as the result of boring experiments in 1921 have since been confirmed by developments elsewhere, so that the oilfield is now ready for exploitation.

Its discovery was quite accidental. Mr. J. Berry, of Watchet, a mining engineer, while on a visit to the district in 1914 from South Africa, where he had a large experience as a prospector, was interested in the considerable quantity of shale along the shore. While examining portions he detected the presence of oil, and on samples being sent to a laboratory the results were surprisingly good.

On the authority of Dr. Leslie, the shales between Watchet and the River Parret are computed to contain many million tons of lubricating oil, to say nothing of petroleum and by-products.

It is to develop the sources of supply that steps are now being taken. Should the efforts to this end be successful—and the promoters are confident they will be—the whole industrial situation in the area between Watchet and Bridgwater will undergo a welcome change. The unemployed in the district would, it is thought, soon be absorbed once the development of the oilfield began, and it might result in the revival of the project to construct a railway between Bridgwater and Watchet.

It is hoped that the development of the oil will be in operation before the end of the year.

An Encouraging Feature

A correspondent of *The Times Trade Supplement* states that the most encouraging feature of last year's export trade in China Clay has been the extraordinary revival of demand in the American markets. In the face of the cry often raised that American domestic clays are seriously cutting into the Euglish product, the restoration of demand, now that more normal conditions prevail, has been very encouraging to the English producers. The home clays that the American domestic clays affect most are the common grades, but in the best grades the English clays are unrivalled.

As regards the cheaper grades, there is a growing demand both at home and on the Continent, the latter particularly, where our producers are becoming increasingly successful in competing with foreign clays which secured a temporary foothold during and since the war. The reduction in price of the cheaper grades by 3s. per ton commencing with the New Year is still further helping to stimulate trade in this direction.

The increase of the American tariff against China Clay, which was anticipated, does not appear to have interrupted the demand, which has continued into the New Year, with substantial orders ahead. In the home markets and the European markets the year has also opened well, but it is feared that the Reparations crisis will have a disturbing effect upon the latter if unduly prolonged.

St. Austell £65,000 Will

Though not actually engaged in the China Clay industry, Mr. John Stephens, whose will has just been proved at £65,024 gross, with net personalty £52,678 7s. 10d., had a good deal of experience with legal work in connection with the industry. He was brother-in-law of Mr. John Lovering, of Messrs. John Lovering and Co., and for a great number of years clerk to the St. Austell Guardians and Rural Council. Amongst his bequests were £7,000 (duty free) and other property to his nephew, Mr. Cecil Lovering, £10,000 (duty free) and other property, together with personal and household effects, to Mr. J. S. Lovering (a partner in the firm of John Lovering and Co., and one of the joint managing directors of Associated China Clay Ltd.). He also left £5,000 (duty free) to Mr. W. H. Bettison, his confidential clerk, who is now clerk to the St. Austell Parish Council and rate collector. The residue of his estate he left to his sister, Mrs. John Lovering, for life, and after her decease to his nephews, Messrs. J. S. Lovering and Cecil Lovering.

China Clay Propaganda

The China Clay industry is making use of the Cinema for the purpose of extending knowledge on the production and uses of China Clay. Following a recent private show to the trade, the China Clay film was recently shown at the St. Austell Cinema, and is considered excellent as a piece of industrial propaganda. It shows the various processes through which China Clay has to pass before it is ready for use in the manufactures, and demonstrates the care displayed by the producers of China Clay to supply a commodity whose suitability for a variety of uses demonstrates its purity and versatility. It is intended to show the film in the manufacturing centres in this country—notably in the Potteries, Midlands, and Lancashire, and also in the United States of America. It is gratifying to note that the China Clay industry is more and more awakening to the advantages of propaganda for extending markets.

Messrs. Pochin and Co. and St. Dennis Memorial

The interest taken by China Clay firms in the social and communal life of the employees was again recently demonstrated at St. Dennis, when a handsome war memorial Institute was recently opened by Mrs. McLaren, the wife of the Hon. H. D. McLaren, C.B.E., a director of Messrs. Pochin and chairman of the Associated China Clay, Ltd. In addition to contributing £250 to the memorial fund, the Hon. H. D. McLaren and his firm installed a high-power five-valve wireless set at the institute. Mr. McLaren presided at the luncheon that preceded the opening ceremony, and Mr. Stanley Pochin, J.P., submitted the toast of "Success to the Institute." A tablet on the front of the Institute records the names of the 49 men of the St. Dennis parish who lost their lives in the war. The outstanding feature of the ceremony was the beautiful oration of Mrs. McLaren in declaring the institute open. It revealed the fact that she is an orator.

China Clay at the British Empire Exhibition

At the St. Austell Rotary Club luncheon recently, Capt. H. T. W. Bousfield, on behalf of the publicity department of the British Empire Exhibition, explained its objects and scope. The statement that arrangements were being made with a view to the China Clay industry's products being exhibited was welcomed by China Clay producers present. Mr. E. J. Hancock welcomed the fact that the exhibition would be in charge of trade associations, thus avoiding the exploitation of a national exhibition by private firms for advertising purposes.

Rubber Latex for Coating China Clay

To the Editor THE CHINA CLAY TRADE REVIEW.

SIR,—A substance of general interest to the China Clay trade is China Clay coated with rubber latex by our process, as described in THE CHEMICAL AGE (31/3/23, p. 328). It forms a perfect filler for rubber goods, and, in the paper trades, tests show that whereas ordinary clay is a weakener, coated clay is a strengthener, and perhaps, at present, the only commercial use for latex is in paper making.

The process is very simple. The clay, in water, is peptized by the addition of alkaline latex in the desired percentage. A precipitant is then added when all the particles fall, each coated with rubber, leaving a clear water-white solution, showing all the latex to have been taken up. On filtering and completely de-hydrating, the rubber coatings cohere, so that the substance can be directly applied to waterproofing if sufficient quantity of latex be used in the coating. In paper the particles adhere and key to the paper fibres on drying.—

Yours, etc.,

G. C. CALVERT.

The Metropolitan Laboratories,
Twickenham, Middlesex.

Paper Maker on Latex

Mr. F. Heckford, the chief chemist to Messrs. John Dickinson and Co., Ltd., the paper makers, recently addressing the S.W. London Master Printers' Association, said paper makers did not take kindly to the use of rubber latex because it was very difficult to work rubber into paper because it coagulated. Certainly latex produced a paper that was more elastic, but often the strength of it was not increased thereby. On the other hand, the Rubber Growers' Association states that latex has been employed for every class of paper, and has been proved to give better results on the printing machine than the same paper without latex.

Paper Exports and Imports Increasing

Exports of paper have been steadily advancing during the year, each month showing an increase on the previous month. The aggregate for the five months ended May were 52,000 tons in excess of the corresponding period last year. The imports of paper have also increased greatly, 227,500 tons against 184,250 tons. These imports are almost wholly for home consumption—a matter of serious consideration for home paper makers, who could meet the whole of the demand. A feature of these imports is the quantity coming in from Germany, where the slump in marks favours the export trade.

Canadian Paper Production

Canada is becoming an increasing market for English China Clay on account of the steady growth in the number of paper-making machines. In the first four months of the year 398,835 tons of news print was produced against 329,416 tons for the same period last year, an increase of 64,419 tons. As an indication of the increase in Canada's paper production, ten years ago it was only 350,000 tons yearly, in 1922 the total production was 1,090,000 tons. This year it is predicted that production will reach 1,290,820 tons. The average daily production is 4,315 tons.

Big Newfoundland Paper Development

The Anglo-Newfoundland Development Co. at Grand Falls, the concern that is under the control of the Associated Newspapers, Ltd., have recently acquired the neighbouring mill at Bishop's Falls. It is also reported that arrangements have been made to acquire the share capital of A. E. Reed and Co. (Newfoundland) Ltd., which has a well-equipped pulp and paper mill within 11 miles of the Anglo-Newfoundland's mills, and which has a capacity of over 28,000 tons a year.

The Ball Clay Industry

It is gratifying to observe that the Ball clay industry, particularly in the North Devon area, seems to synchronise with the improvement in the Cornish China Clay industry, and most of the firms have experienced brisk business for some time. Although the demand for this product in our English potteries has varied, orders have been flowing in from other countries, principally America, which have kept trade fairly busy. The new railway has given quite an impetus already to the industry and will confer a great boon to Ball clay producers in that locality. In some cases the clay has to be sent eleven miles by a fleet of motor lorries, and as soon as the line is complete the firm will have their own railway siding, thus effecting a considerable saving in costs of production as well as an appreciable lessening of the local rates by withdrawal of such abnormal heavy traffic from the roads. It will not be many months before the last rail of the new line will be laid, and the district which had been almost inaccessible will be brought into closer connection with the outside world. It is difficult to estimate the great benefits such a railway will confer not only on the community but in the way this new artery of transport will be of value to the potter. It will undoubtedly open up one of the largest tracts of Ball clay-bearing land in Devon, the county which produces the cream of the Ball clay all over the civilised world. Other corners produce Ball clay, but the demand for Devon "Blue Ball Clay" reflects very accurately the merits of the product which Devon sends out to the potters of many lands. The cutting from Halwill Junction towards Highampton has been completed for some miles and all that remains is the laying of the permanent rails and sleepers. The work is proceeding at other points and early in another year the line should be completed. The cost is estimated to be about £250,000, towards which a grant of £125,000 has been made by the Government.

The Manufacture of Aluminium Sulphate

Recovery from China Clay

According to a German authority the best aluminium sulphate can, without doubt, only be made from aluminium hydrate. This class of raw materials comprises the bauxites, of which there are only small deposits in Germany, in Upper Hesse. French bauxites, formerly purchased by Germany, are now too expensive, owing to the rate of exchange; and Hungarian bauxite is burdened with heavy tariffs for carriage. There is, however, a sufficiency of Kaolin in Germany which might be utilised for manufacture of aluminium sulphate for paper mills in greater quantities than at present. It may be pointed out that the exigencies of paper makers, with regard to the percentage of iron in aluminium sulphate, are greatly exaggerated. There was formerly an aluminium hydrate free from iron and sold at very low prices, and there was no reason why the manufacturers should not look for products of greater purity, even beyond reasonable limits. These remarks relate to paper only, for such pure products could not be demanded for the dyeing industry; but formerly there was no need for this distinction. Circumstances, however, are now quite different, consumers grumbling at the continual increase in the prices of paper, and some means to decrease the cost of manufacture is wanted. This is not possible with imported hydrates, but can be accomplished by employing native kaolin for aluminium sulphates.

A normal kaolin contains 0·75 per cent. Fe_2O_3, together with 34 to 35 per cent. Al_2O_3 and 50 per cent. SiO_2. As the product is attacked with acid, the iron enteres into solution, and we practically obtain with 100 lb. of kaolin (=34 lb. of Al_2O_3), 200 of aluminium sulphate, with 14 to 15 per cent. Al_2O_3. These 200 lb. should, of course, contain all the iron of the raw material—viz., 0·750 or 0·37 to 0·38 lb., calculated in the final product. This quantity is evidently excessive, but an average should be found between the 0·002 per cent. Fe_2O_3 of a product derived from aluminium hydrate and the 0·37 per cent. Fe_2O_3 of that from kaolin. The iron can, of course, be eliminated by more or less expensive methods, but, it must be remembered that what is wanted is a cheap method of manufacture. Hitherto a purified aluminium sulphate from kaolin has not been offered at much smaller prices than that of the hydrate.

In the place referred to a light French bauxite with 60 per cent. Al^2O^3 and 3·5 per cent. Fe_2O_3 was being worked by direct treatment with sulphuric acid. Theoretically, the 100 lb. of bauxite, containing 60 per cent. Al_2O_3 should give 400 lb. of aluminium sulphate with 15 per cent. Al_2O_3, and these 400 lb. of finished product should contain 2½ lb. of Fe_2O_3—viz., 0·9 per cent. Fe_2O_3. But it only contained 0·1 per cent. Fe_2O_3, and with careful work it was possible to attain 0·075 per cent. Fe_2O_3, which is an appreciable result.

If with a bauxite containing 61 per cent. Al_2O_3 and 3·5 per cent. Fe_2O_3 a sulphate, with 0·075 per cent. to 0·10 per cent. Fe_2O_3, can be obtained—viz., only one-tenth the theoretic quantity, it should not be difficult to obtain, with kaolin containing 34 per cent. Al_2O_3 and only 0·75 per cent. Fe_2O_3, a product to meet all the requirements of paper making, even for fine quality of paper.

Twenty years ago a works manufactured, in addition to this aluminium sulphate mentioned as extracted from kaolin, an aluminium sulphate from bauxite, with 0·002 per cent. Fe_2O_3, and also potash alum of superior quality, used even in pharmacy.

About 30 minutes' walk from one factory near Dresden there was a small leather-dyeing works which utilised alum, and for years this alum came from Paris. It was waste of time trying to persuade the manufacturer to make at least a small trial. He could have taken all the alum he required from the adjacent works in a wheelbarrow, with nothing to pay for duty and carriage. Perhaps, even, he used the actual alum as large quantities were exported. As early as 1894 Jurisch stated, in his book, that an aluminium sulphate with a maximum of 0·15 per cent. Fe_2O_3 could be used without inconvenience for newspaper paper, and even letter paper. But this was ignored because consumers were prejudiced by the low prices of aluminium hydrate products. The hydrate from Hesse should be kept for aluminium works only, reserving that strictly necessary for fine qualities of paper.

Industrial and Trade Reports

(From our Own Correspondents and Other Sources)

Great Britain

Tehidy Minerals' Improved Outlook

Tehidy Minerals, Ltd., is one of the leading enterprises in Cornwall associated with the mining industry. It owns the mineral rights of the Tehidy estate, which Mr. C. A. Moreing has described as probably the finest stretch of mineral ground to be found anywhere. It has also very large China Clay interests. So far, the times have been unfavourable for making profits, but the company may now be regarded as on the high road to what bids fair to be long-continued prosperity. The report for 1922 shows a profit of £3,749 as compared with a loss in the previous balance sheet of £9,965. But, whereas on the last account there was a debit balance of £2,588, there is now a credit of £1,160 carried forward. The present report states that "there is a much brighter outlook for Cornish tin, as well as clay, industries, and every reason to believe that several of the tin mines will be in the producing stage in the coming year." The revival in the China Clay trade has been very marked. The directors lament the death of their colleague, Mr. John Gilbert, whose experience of tin mining and China Clay working was of great service to the company. Mr. Moreing has resigned his seat on the board, but his firm remain general managers, and it is to their very complete and interesting report to which we now pass.

The China Clay interests are in a prosperous condition. The year 1922 saw quite a revival in that industry, as is shown by the fact that the total turnover of Devon and Cornwall was 737,486 tons—the best pre-war output being 900,000 tons. Tehidy Minerals, in this prosperity, is sharing both as a producer and as a receiver of dues. Cornish produce maintains its pre-eminence for the quality of its China Clay, and seems to be able to set tariffs at defiance. The general managers particularly mention the great activity in the Halviggan works, and of Cornish Kaolin, Ltd., in both of which Tehidy Minerals is interested. Developments at the Halviggan pits, which are now thoroughly equipped, have been specially encouraging, and a similar observation applies to Cornish Kaolin. When at the latter the third "dry" is completed the annual capacity of 40,000 tons can be reached. The managers conclude an able, and an exceptionally interesting, report by saying: "We have given much time and care to the examination of the, as yet, untouched mineral resources of your extensive property and believe that the favourable developments of the past year, the improved demand for tin and arsenic, and the gratifying revival in the China Clay trade will all serve to stimulate interest in these areas, expediting their further development, whilst the resumption of operations in a number of important mines and the expansion of the China Clay trade must correspondingly improve the revenue position."

China Clay Developments at Shipley

According to the *Western Morning News*, everything points to the operations at the old works of the Dartmoor China Clay Company at Shipley, South Brent, being successful. During the past five weeks a considerable amount of pioneer work has been accomplished, and already the output has reached about 40 tons per week, while a dozen workers are employed. After over 40 years' idleness these old works have been restarted along with new pits on the western side of the old pits at Yellowbrook, while the "prospectors" have met with a promising yield in the vicinity of Whitebarrow. The manager of the undertaking, a St. Austell man, who has been brought up in the midst of the china clay industry, is doing his utmost to make the scheme a success. He has secured an area of about 15 square miles on lease for 40 years, and when the work is further advanced it is expected that over 1,000 tons of clay per week will be produced.

Engineers who have visited the scene of the operations have expressed surprise at the manner in which the work has been advanced within the short period of five weeks. Already "the milky way" has appeared on the moorside, where the channels with the clay in liquid form provide miniature cascades until the liquid reaches the series of pits or filter beds. Everything is being done to minimise pollution of adjacent waterways, but it is contended that the filtered solution is harmless to fish.

The promoters of the scheme have been fortunate in finding the old line of pipes which lead the liquid from the pits to Shipley drying sheds. Except in cases where rabbits have played havoc with this aquaduct the pipe line is in a state of good repair. Workmen are being kept busy repairing the pipe track, which extends over four miles over the moorland, and also the various pits at Shipley.

About 3,000 tons of clay are under cover, and as the work advances the tall, square, granite chimney stack, which has been a familiar landmark in the vicinity of Shipley for several decades, will be brought into use, while the adjacent drying sheds, drying apparatus, and the old stores will be reconstructed.

The contract has been fixed for the introduction of motor transport to handle the clay from Shipley to Brent. According to the promoters, the quality of the clay is equal to the best placed on the market, and they are hopeful that a large number of extra men will be required in connection with this development of the industry in Devonshire.

English China Clay Prices

China Clay, in bulk, f.o.b. Cornwall, 28s. 9d. to 71s. (highest grade) per ton. The extra charges (including filling) per ton for bags and casks are; Single bags, 9s. 6d.; double bags, 16s. 6d.; half-ton casks, 19s. 6d.; quarter-ton casks, 22s. 6d., in casks, with extra iron hoops, 2s. per ton extra.

Prices of English China Clay in U.S.A.

English clay, ex steamer, per ton	14.00 to 20.00
Domestic clay, washed, per ton	8.00 to 10.00
Domestic clay, unwashed—No. 1 per ton	6.00 to 7.20
No. 2	5.00 to 6.00

China Clay in Malaya

The Malayan China Clay and Pottery Co., Ltd., has recently been taken over by a new company entitled Malayan China Clay and Potteries, Ltd. From the prospectus of the new company interesting information as to the possibilities of this industry in British Malaya is available. In addition to concessions giving the right to work China Clay deposits and to cut firewood, prospecting licences, plant machinery, etc., the new company has acquired from the old company a concession from the Federated Malay States Government granting the sole right to export China Clay and china-stone from the Federated Malay States for a period of seven years from January 1, 1921.

With the materials at its disposal the company states that it will be possible to manufacture pottery of all descriptions (including porcelain), white and coloured glaze tiles, firebricks, stoneware, pipes, glassware, building bricks, roofing tiles, glazes and colours, distempers and colour washes. The whole of the necessary plant for the preparation of the company's raw material is said to be complete, but further machinery for the efficient manufacture of many articles is still necessary.

It is claimed that all raw materials required in bulk for the manufacture of its products are available within a few miles of the company's works, there is a cheap and abundant supply of labour, direct railway communication with distributing centre is at hand, and there is a large local market for the manufactured articles, with the result that the company is in a unique position to compete with rival enterprises, and in particular with the China Clay industry of the West of England.

The Late Mr. A. Edmund Spender

The unexpected death at Shrewsbury of Mr. A. Edmund Spender, following an operation, came as a shock to his many friends in the West of England. He was related to the Spenders who are prominently connected with London journalism, and until the *Western Morning News* was acquired by one of the Harmsworths had been manager of that paper for many years. He was financially interested in the China Clay industry from his advent in the West of England, and retained an interest up to the end, but West of England journalism in connection with the *Western Morning News* was always his main interest.

Shipping and Export News of the Month

We give below the latest particulars relating to arrivals and sailings of ships engaged in the China Clay Trade, at the principal British clay ports. Registered exports of China Clay with countries of destination, and other shipping and export matters are dealt with.

Shipping—Fowey, June, 1923

Arrived.		Vessel's Name.	Sailed.	
June 1,	S.V.	*Amanda*	June 8,	Weston Point
June 2,	S.S.	*Ewy*	June 4,	Leith
June 2,	S.S.	*Ualan*	June 9,	Brussels
June 2,	S.S.	*Norwich City*	June 9,	Portland, Me.
June 2,	S.V.	*Alert*	June 7,	Weston Point
June 2,	S.V.	*Hilda*	June 12,	Leith
June 2,	S.V.	*John Sims*	June 3,	Plymouth
June 2,	S.S.	*Munksfors*	June 6,	Gothenborg
June 3,	S.S.	*St. Tudwald*	June 7,	Preston
June 3,	S.S.	*Whinhill*	June 6,	Liverpool
June 3,	S.S.	*Moss Rose*	June 4,	Runcorn
June 4,	S.S.	*Florentino*	June 8,	Genoa
June 4,	S.S.	*Jersey City*	June 15,	Philadelphia
June 5,	S.V.	*Undine*	June 14,	Harburg
June 5,	S.V.	*Regina*	June 12,	Southampton
June 6,	S.S.	*Mary Summerfield*	June 8,	Gravesend
June 6,	S.V.	*Daisy*	June 12,	Runcorn
June 6,	S.S.	*Southener*	June 9,	Bo'ness
June 7,	S.S.	*Spinner*	June 12,	Brussels
June 7,	S.V.	*John Farley*	June 19,	Runcorn
June 7,	S.S.	*B. W. III.*	June 14,	Antwerp
June 8,	M.V.	*Vildanden*	June 14,	Skien
June 8,	M.V.	*Elly*	June 14,	Kotka
June 9,	S.S.	*Falmouth Castle*	June 13,	Runcorn
June 9,	S.S.	*Mersey*	June 13,	Fleetwood
June 9,	S.S.	*Farfield*	June 9,	Ridham
June 9,	S.S.	*Spaarnestroom*	June 14,	Amsterdam
June 9,	S.V.	*Englishman*	June 20,	Weston Point
June 9,	S.S.	*Collin*	June 13,	Lancaster
June 11,	S.S.	*Dunaff Head*	June 21,	Portland, Me.
June 14,	S.S.	*Primrose*	June 16,	Preston
June 14,	S.S.	*Joffre Rose*	June 15,	Rouen
June 14,	S.V.	*Aneroid*	June 20,	Harburg
June 14,	S.S.	*Guelder Rose*	June 16,	Antwerp
June 14,	S.V.	*Ada*	July 3,	Runcorn
June 15,	S.S.	*Glenbrook*	June 16,	Newcastle
June 15,	S.S.	*Moss Rose*	June 16,	Fleetwood
June 15,	M.V.	*Lydia Cardell*	June 23,	Antwerp
June 15,	S.S.	*Tanny*	June 18,	Newlyn
June 15,	S.S.	*Branstone*	June 20,	Nantes
June 17,	S.S.	*Nordborg*	June 22,	Archangel
June 18,	S.S.	*Farfield*	June 21,	Antwerp
June 18,	S.V.	*Olive Branch*	June 25,	Runcorn
June 19,	S.V.	*Seierskransen*	June 27,	Trongsund
June 19,	S.V.	*Chieftain*	June 25,	Snodland
June 19,	S.S.	*Falmouth Castle*	June 22,	Runcorn
June 20,	S.S.	*Seaforth*	June 22,	Runcorn
June 20,	S.V.	*Menai*	June 25,	Ardrossan
June 21,	M.V.	*Drogden*	June 25,	Gothenborg
June 21,	S.S.	*Sotero*	June 23,	Genoa
June 22,	M.V.	*Hetty*	July 5,	Weston Point
June 22,	S.V.	*Cetus*	June 28,	Rochester
June 22,	S.S.	*Marnix*	June 26,	Leith
June 22,	S.V.	*Edith*	June 25,	Pentewan
June 22,	M.V.	*Diolinda*	July 2,	Runcorn
June 23,	S.S.	*Leaside*	June 27,	Antwerp
June 23,	S.V.	*Waterwitch*	June 30,	Leith
June 24,	S.S.	*Elmpark*	July 3,	Boston, U.S.A.
June 24,	S.S.	*Moss Rose*	June 28,	Preston
June 25,	S.S.	*Alkmaar*	June 30,	Teignmouth
June 25,	S.S.	*Devon Coast*	June 28,	Birkenhead
June 25,	S.S.	*Brier Rose*		Runcorn
June 25,	S.S.	*Vechstroom*		Amsterdam
June 25,	S.S.	*Mersey*	June 27,	Gravesend
June 27,	S.S.	*Sutton*	June 29,	Ridham
June 27,	M.V.	*Roglund*	June 30,	Anvers
June 28,	S.S.	*River Humber*		Newlyn
June 28,	S.S.	*Liana*	July 3,	Brussels
June 28,	M.V.	*William Prichard*	July 4,	Preston
June 28,	S.V.	*Carl*	July 11,	Plymouth
June 29,	S.V.	*Lady Daphne*	July 7,	Snodland
June 29,	S.V.	*Emily Warbrick*	July 6,	Runcorn
June 29,	M.V.	*Emperor*	—	
June 29,	S.S.	*Pansy*	July 3,	Preston
June 30,	S.S.	*Lakewood*	July 4,	Santander

Par Harbour Shipping—June, 1923

Arrivals

Date.		Vessel.	From.
June 1.....	S.V.	*Glenway*	Plymouth
June 5.....	S.V.	*J.N.R.*	Plymouth
June 5.....	S.V.	*Kate*	Plymouth
June 6.....	S.S.	*Eddie*	Plymouth
June 6.....	M.V.	*Progress*	Truro
June 7.....	S.V.	*Eclipse*	Plymouth
June 11.....	S.V.	*Snowflake*	Runcorn
June 11.....	S.V.	*Venta*	Plymouth
June 11.....	S.V.	*Two Sisters*	Plymouth
June 13.....	S.S.	*Roseabelle*	Sharpness
June 14.....	M.V.	*Moucheron*	Dover
June 14.....	S.S.	*Tynesider*	Hull
June 16.....	S.V.	*Fanny Crossfield*	Salcombe
June 16.....	S.V.	*J.N.R.*	Plymouth
June 18.....	S.S.	*Queenie*	St. Breaux
June 19.....	M.V.	*Mary B. Mitchell*	Cardiff
June 19.....	S.V.	*Triumph*	Plymouth
June 22.....	S.V.	*Hosianna*	Plymouth
June 22.....	S.S.	*Eddie*	Padstow
June 22.....	M.V.	*Isabel*	Plymouth
June 25.....	S.S.	*Tanny*	Bristol
June 28.....	S.V.	*Rothersand*	Mevagissey
June 29.....	S.S.	*Deloraine*	Sharpness
June 29.....	S.V.	*Triumph*	Plymouth
June 29.....	M.S.	*Csardas*	London

Sailings

Date.		Vessel.	Destination.
June 2.....	S.V.	*Lilla*	Ardrossan
June 3.....	M.V.	*Olive May*	Rochester
June 3.....	M.V.	*Garlandstone*	Gloucester
June 3.....	S.V.	*Glenway*	London
June 11.....	M.V.	*Progress*	Penarth
June 12.....	S.V.	*Eclipse*	Pentewan
June 12.....	S.S.	*Eddie*	Preston
June 14.....	S.V.	*Duchess*	London
June 14.....	S.V.	*Flying Foam*	Glasgow
June 14.....	S.S.	*Roseabelle*	St. Malo
June 15.....	S.V.	*Devonia*	Newcastle
June 16.....	S.S.	*Tynesider*	Poole
June 19.....	S.V.	*Pet*	Runcorn
June 19.....	S.V.	*Two Sisters*	Ghent
June 19.....	S.V.	*J.N.R.*	Pentewan
June 19.....	S.S.	*Queenie*	Preston
June 20.....	M.V.	*Moucheron*	Rouen
June 21.....	S.V.	*Triumph*	Plymouth
June 21.....	S.V.	*Snowflake*	Runcorn
June 21.....	M.V.	*Isabel*	Poole
June 25.....	S.S.	*Eddie*	Runcorn
June 26.....	S.V.	*Fanny Crossfield*	Grimsby
June 26.....	S.V.	*Hosianna*	Portsmouth
June 27.....	M.V.	*Mary B. Mitchell*	Western Point
June 29.....	S.S.	*Tanny*	Penarth
June 30.....	S.S.	*Deloraine*	Penzance
June 30.....	S.V.	*Triumph*	Plymouth

Charlestown Shipping—June, 1923

Arrivals

Date.	Vessel.	From.
June 1.....	*Major*	Kingsbridge
June 3.....	*Marna*	Christiansand
June 5.....	*Valonia*	Plymouth
June 8.....	*Amy*	Fowey
June 8.....	*Leonard Piper*	Plymouth
June 13.....	*Louistic*	Plymouth
June 14.....	*Naiad*	Cardiff
June 16.....	*Fox*	Exeter
June 16.....	*Mary B. Mitchell*	Cardiff
June 21.....	*Christiana*	Skibbereen
June 21.....	*Black Cat*	Looe
June 21.....	*Madeleine*	Cardiff
June 22.....	*Lord Haig*	Torquay
June 24.....	*Lochaber*	Portreath
June 24.....	*Lady Rosebery*	Exeter
June 25.....	*Leeuwerik*	Fredrichamm
June 26.....	*Guardian*	Plymouth

June 28.....	*Deux Freres*.....	Havre
June 28.....	*Poole*	St. Ives
June 28.....	*Rose*	Goole

Sailings

Date.	Vessel.	Destination.
June 1.....	*Coniston*	Rouen
June 5.....	*Major*	London
June 7.....	*Valonia*	London
June 11.....	*Leonard Piper*	London
June 14.....	*Amy*	Newcastle
June 15.....	*Marna*	Leith
June 16.....	*Louistic*	Nantes
June 16.....	*Fox*	London
June 25.....	*Christiana*	Barrow
June 25.....	*Black Cat*	London
June 25.....	*Madeleine*	Nantes
June 26.....	*Lord Haig*	Rochester
June 26.....	*Lochaber*.....	Fleetwood
June 27.....	*Naiad*	London
June 29.....	*Deux Freres*.....	Brussels
June 29.....	*Poole*	London
June 29.....	*Lady Rosebery*	Rochester
June 29.....	*Guardian*	Treport

Par Harbour Tide Table, July, 1923

(British Summer Time throughout.)

Day of Week.	Day of Month.	Morning.	Afternoon.	Height.
SUNDAY	1	8.10	8.30	12.11
Monday	2	8.50	9.10	12.5
Tuesday	3	9.30	9.49	11.10
Wednesday	4	10.10	10.29	11.3
Thursday.....	5	10.30	11.12	10.7
Friday	6	11.35	11.59	10.2
Saturday	7	—	0.28	10.10
SUNDAY	8	0.59	1.33	10.10
Monday	9	2.8	2.41	10.1
Tuesday	10	3.12	3.42	10.7
Wednesday	11	4.10	4.37	11.2
Thursday.....	12	5.2	5.25	11.8
Friday	13	5.47	6.8	12.1
Saturday	14	6.29	6.50	12.4
SUNDAY	15	7.10	7.30	12.7
Monday	16	7.49	8.8	12.10
Tuesday	17	8.28	8.48	12.9
Wednesday	18	9.8	9.30	12.7
Thursday.....	19	9.50	10.11	12.2
Friday	20	10.35	11.0	11.8
Saturday	21	11.27	11.56	11.2
SUNDAY	22	—	0.28	10.10
Monday	23	1.3	1.40	10.10
Tuesday	24	2.18	2.56	11.3
Wednesday	25	3.32	4.7	11.10
Thursday.....	26	4.39	5.9	12.5
Friday	27	5.37	6.3	12.9
Saturday	28	6.28	6.51	12.11
SUNDAY	29	7.13	7.33	13.0
Monday	30	7.52	8.11	13.0
Tuesday	31	8.29	8.47	12.8

H. L. VICARY, Harbour Master.

June China Clay Deliveries

Drop from May Total

OWING to the shipments to America not being so heavy, the total deliveries of China Clay during June showed a falling off from 84,774 tons in May to 71,347 tons. Despite this the monthly total was well up to the monthly average for the six months this year, and well above the monthly average of 60,000 tons last year. Details of deliveries for June are—

Port.	Tonnage.
Fowey	56,751
Charlestown	4,174
Par	3,648
St. Blazey	1,598
Plymouth	447
	66,618
By rail	4,729
	71,347

Against 57,361 tons, June, 1922.

Arrivals of China Clay in Antwerp

WE give below particulars of arrivals of China Clay in the port of Antwerp during the month of June :—

From Poole	SCH.	*Pedestrian*	217 tons
From Teignmouth	M.S.	*Romanie*	345 tons
From Fowey	S.S.	*B.W. III.*	483 tons
From Fowey	SCH.	*Margaret Obly*	190 tons
From Fowey	S.S.	*Farfield*.....	458 tons
From Fowey	SCH.	*Lydia Cardell*.....	365 tons

Exports of China Clay

RETURN showing the exports of China Clay, including Cornish or China stone.

The produce of manufacture of the United Kingdom from the United Kingdom to each country of destination registered during the month ended June 30, 1923.

COUNTRY OF DESTINATION	QUANTITY Tons	VALUE £
Finland	3,595	7,117
Sweden	1,197	3,081
Norway	2,859	5,355
Germany	542	1,630
Netherlands	1,443	3,807
Belgium	3,836	8,001
France	3,285	6,899
Switzerland	51	122
Portugal	10	44
Spain	1,173	3,860
Italy	1,589	4,762
Greece	35	150
United States—on the Atlantic.....	32,674	75,736
United States—on the Pacific	269	891
Mexico	30	118
Brazil	20	94
Argentine Republic	6	45
Natal	—	1
Bombay, *via* other Ports	578	2,306
Madras	15	60
Bengal	147	626
Victoria	6	27
New South Wales	14	74
Canada—on the Atlantic	149	617
Irish Free State	19	71
South Australia	10	40
Total	53,552	125,534

Commercial Intelligence

County Court Judgment

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.]

TURNER, T., AND CO., New Mills, paper merchants. £13 16s. 5d. May 7.

Mortgages and Charges

*[NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]*

BRITTAINS, LTD., Hanley, paper makers.—Registered June 29, £20,000 debentures part of amount already registered; general charge. *£30,000. April 3, 1923.

CORMACEY (H.) AND CO., LTD., London, E.C., paper makers.—Registered June 27, £7,000 debentures; general charge.

The China Clay Trade Review

The Official Organ of the China Clay Industry and the only Journal specially devoted to its interests. Published in the third issue of "The Chemical Age" each month.

All Editorial communications should be addressed to the Editor, "The China Clay Trade Review," Benn Brothers, Ltd., 8, Bouverie Street, London, E.C.4. All communications relating to Advertisements, Subscriptions, and other business should be sent to the Manager, "The China Clay Trade Review," at the same address. Telegrams—"Allangas, Fleet, London." Telephone—City 9852 (6 lines).

Contents

New Methods in Vogue

THE China Clay mines and china stone quarries of Cornwall and Devon are more and more adopting mechanical means of production and transit of China Clay in substitution for unskilled manual labour. It has often been a matter for criticism by outsiders that those engaged in the China Clay and china stone industry have been reluctant to introduce machinery to cope with certain sections of work almost wholly done by manual labour. For the producers it must be conceded that they are first of all men of business and have not been quick to displace manual labour with machinery unless it could be shown that the ultimate cost would be less than that of manual labour.

Under the conditions that prevailed before the war the margin of saving on labour costs was not so apparent as it is to-day. Undoubtedly the effect of the increased cost of labour is to induce producers to utilise mechanical means wherever possible. Under the changed conditions produced by the war, the tendency in the clay mines and stone quarries in future will be that more and more machinery will be used. This will lessen the demand for unskilled labour, which has been fairly considerable in the past.

The processes in the preparation of China Clay for market, which have afforded the most scope for unskilled labour, have been the washing of the clay in the pits, the removal of overburden from the beds of clay, the drying of the clay in the kilns, and loading and carting In all except the drying process, manual labour is being diminished to a greater or lesser extent.

For some years before the war a few works had introduced hydraulic hoses for washing the clay, it being found that the enormous pressure of water obtainable by this method was sufficient to wash the clay without the aid of men to break it up first. So economical has this method proved that what was formerly a novelty is now being generally employed.

In the removal of overburden, steam navvies have been employed by some works on a moderate scale, and so effective and economical have they proved to be in the removal of large quantities of overburden that their more general introduction is contemplated by works where this work at present entails heavy manual costs. In some mines the overburden is very heavy.

At some works adapted for them, the introduction of portable conveyors for transporting debris, sand and clay from one part of the works to another, and of aerial ropeways for conveying material long distances have recently been introduced.

In the opening of the new pits and quarries and the extension of old ones a good deal of shaft sinking and level driving is entailed, also the encountering in normal China Clay development of large boulders of rock which have to be blasted before removal. The practice of drilling holes by the old-fashioned hammer and hand-drill has survived in the clay works long after it has been relegated to the limbo of forgotten things in the tin mines further west. But even this old, slow and laborious method, involving big labour costs, is being superseded by the more up-to-date and effective mechanical rock drill, which can be operated by one man where several were formerly required. This handy little machine, driven by compressed air or electrically, is proving a boon in several China Clay mines and china stone quarries in the West of England.

In the transport of China Clay there have been many developments, mainly in the adoption of the principle in vogue in the oil industry, of piping the clay in a liquid state to the kilns alongside the railways. This is a great advantage over drying at the works where the clay is raised, for it cuts out the cost of transporting clay by road, often a distance up to five miles. In the kilns themselves various mechanical contrivances are used for transferring the thick clay from the tanks to the pan, the chief of which is the travelling platform from which the clay is spread over any part of the pan.

Cornish and Other Clays

WE have frequently drawn attention in these pages to the value of publicity in seeking to extend the markets for China Clay, but we have sometimes wondered if the Cornish producers fully realise that, *at present*, they have a raw material unexcelled for the purpose for which it is used in any other part of the world.

We say, *at present*, because we are by no means the only journal which has pointed out that other countries are producing and selling China Clay. These clays may not be equal to the English, but they are finding a market which the home producers ought to be able to keep.

So long as Cornish producers are content "to hide their light under a bushel" they will neither capture new markets nor retain the old.

Propaganda and publicity work are essential to the growth of any trade, but in the China Clay industry it appears to be left in the hands of one or two of the larger firms to advertise the superiority of the Cornish clay.

The China Clay Trade Review has aroused much interest from time to time by devoting a whole page to advertising the many ways in which China Clay can be utilised, and as a trade organ desiring to see a flourishing industry, we make no excuse for publishing in our editorial pages a list of some of the trades at present using China Clay. The paper, pottery, and textile trades take the largest quantities, but some of the lesser known uses are washing and cleansing soaps, water softeners and sewage purifiers, metal and plate cleaners, stove and boot polishes, toilet powders,

cosmetics, tooth powders and pastes, ultramarine, alum, starch, chemical manures and fertilisers, disinfectant powders and paints, crayons, pencils, linoleums, clay beds for handwriting and typewriting duplicators, picture-frame mouldings, asbestos, fire bricks, boiler packing, plaster, whitewash, modelling materials, buttons, knife and fork handles, papier maché, indiarubber, dance compo, cleaners for white canvas shoes, composition for marking out sports grounds, substitute for talc, builders' plaster, sculptors' clay, plaster of Paris, washable distempers, etc. It will be seen by this list, which is of course by no means complete, that there are a large number of trades interested in the use of China Clay, many of whom might be advised, and would probably be glad, to use the new "colloidal" clay, provided it can be marketed at reasonable prices.

Colloidal clay has big possibilities if properly advertised, and may do much towards helping our trade to more than pre-war prosperity. Readers will remember the part played by THE CHEMICAL AGE by publishing the article on China Clay in soap making, by the late Mr. Weston, which aroused much interest at the time and was the first journal to draw public attention to the use of "colloidal" China Clay.

China Clay is one of the most important of the raw materials produced and exported by the "Old Country," but we feel that producers, as a whole, fail to realise the importance of energetic propaganda and publicity work.

The China Clay Trade Review has no other interest than to serve the trade as a whole—the smaller firms equally with the larger ones—and with that end in view it desires to see the world's markets for China Clay retained for Cornwall.

Wake up, Cornwall! Combine "one and all" to let the world know that few foreign clays can equal and none can better the Cornish China Clays.

China Clay in Coated Papers

As by far the largest quantity of China Clay sold is used in paper making, some observations on its use in various kinds of papers should prove interesting. In the first class, what is known as coated art paper which provides a printing surface of the finest quality, the base paper is made in the usual way on the paper-making machine. The machine reel is then taken to the coating machine, where, in the case of a two-sided art, it will receive, on both sides, a coating of mineral white, composed of China Clay and other mineral substances, together with an adhesive to make it bind together and hang to the base paper. It is then rolled to make the surface solid, and brushed to burnish it. In this way a perfectly solid surface can be formed, free from grain and pinholes. The grain of the paper is entirely filled up, so that both sides of the paper present a perfect surface for half-tone printing. The best coated art is made upon an esparto base. This paper, on account of its clear surface, its affinity for China Clay, and its suppleness, gives perfect results and produces an art paper which will fold without cracking. The coated art, in addition to having the best printing surface, has the added advantage of being very opaque.

Another class of paper largely used for half-tone printing is the imitation art. This paper is finished right out on a paper-making machine of special construction. The paper, which is made from esparto grass, has a large percentage of China Clay mixed with the pulp in the vat, and when the paper is nearing the end of its journey a fine spray of water is thrown on to the web, which has the effect of bringing the China Clay to the surface, and the subsequent rolling which it receives gives it a high finish suitable for block printing.

The super-calendered paper is undoubtedly one of the most popular for all-round commercial and publication printing, because of its good printing surface and more moderate price. As its name implies, the paper is calendered after it is made. The machine reel is taken to the calender stacks, and there passed to and fro between many rollers which crush the surface on both sides until the grain is lost, and a perfectly smooth finish secured. With pure papers a very high surface can be obtained on both sides by the use of China Clay so that the underside becomes indistinguishable from the top.

In paper manufacture China Clay is generally added in suspension in water to the prepared pulp, the object of its introduction being to fill up the interstices between the fibres of the pulp, and it has also the effect of giving a smooth surface suitable for the printing of blocks. The addition of kaolin also increases the weight of the paper. The particular qualities required for clays used in paper making are whiteness, fineness of grain, and freedom from grit. Newspaper pulp contains from about 15 to 25 per cent. of China Clay.

Captain Moreing

CAPTAIN MOREING was successful in his candidature at Buckrose where he secured his election to the House of Commons, and soon made his mark. He served as Private Secretary to the Minister of Transport. In consequence of so much of his interests being in the County of Cornwall, Captain Moreing

became the National Liberal nominee for the mining Division of Cornwall at the last general election. Notwithstanding the brief notice and comparatively no organisation he secured victory. The two primary industries of Cornwall, the Tin mining and China Clay production, have in Captain Moreing an unrivalled advocate, particularly the former, which seem to be just emerging from its long period of adversity. The China Clay industry is very fortunate in being represented in Parliament by this China Clay producer, and his commercial and parliamentary experience pre-eminently fit him for the multitudinous duties lying in his path, and his energies as evidenced by the progress of the Crush Kaolin, Ltd., have already borne much fruit. Captain Moreing's sympathies are expressed in the deep interest he takes in all industries and movements which have for their object the general welfare of the country—which has for many generations past, been foremost in the ancient industry of mining, and which has developed and holds the unique position of being the foremost world producer of China Clay. Captain Moreing has shown his great interest for Cornwall by inviting all the Cornish Members of Parliament into line for a united action when problems which do not involve politics are presented affecting the interests of the Duchy—which is sure to be of very great value.

China Clay in Paper Ash

By a Paper Expert

THE complete analysis of an ash obtained from the incineration of a weighed quantity of paper must presuppose that the mineral residue resulting may contain loadings other than merely China Clay. The grade of paper in question largely determines the nature of the ash, since one would hardly expect to find a high class expensive chemical such as sulphate of lime in cheap news, or a heavy substance like Blanc fixe in thin writings. The radical difference between China Clay and barium sulphate is most readily emphasised by reference to their specific gravities, the former being 2·5 and the latter 4·4. The percentage retention in a sheet of paper will therefore vary considerably. In the case of sulphate of lime, or pearl hardening as it is sometimes called, the retention is also further reduced by its slight solubility in water.

The adequate analysis of an ash requires considerable expert treatment, particularly when the presence of two or more loadings is suspected. As a rule the ash does not contain a mixture except in special cases, such as a coated paper surfaced with satin white, wherein the body paper may be loaded with clay.

In such a case the incineration of the paper results in a 30 per cent. ash containing the clay of the body paper, together with sulphate of lime and alumina derived from the coating mixture. A proper analysis of this ash readily determines the clay and satin white separately, and it is also possible to arrive at the results by a careful removal of the coating from the paper, and burning each to ash separately. This is, however, only an approximation, as the coating mixture cannot be entirely removed from the body paper. Some of it is intimately associated with the fibre by the vigorous rubbing to which the coated paper is submitted in its wet state.

We may consider one or two examples.

The Ash is China Clay

The ash after ignition in a platinum crucible is mixed intimately with eight to ten times its weight of fusion mixture, *i.e.*, a mixture of equal parts of dry sodium carbonate and dry potassium carbonate. It is then gradually heated and finally fused at a red heat for 20 to 30 minutes. It is allowed to cool, and the crucible with its contents placed in a beaker containing hydrochloric acid. The mass dissolves, and when the reaction is complete the crucible is removed and washed, the washings being allowed to fall into the beaker. The clay by this process is decomposed into *free silica*, most of which appears in the beaker as a flocculent precipitate, and a sodium salt of *alumina*, which is in solution. The contents of the beaker are evaporated to dryness in a platinum or porcelain dish. This process renders all the *silica* insoluble, and the latter can be filtered off after the dried mass is boiled up with distilled water. The silica is dried, ignited and weighed.

The filtrate contains the alumina as a soluble salt. It is precipitated by the addition of ammonium chloride and ammonia added to the boiling solution. *Alumina* is precipitated. This on filtering, washing and ignition gives all the *alumina* originally combined with the *silica*.

These two items added together give aluminium silicate or China Clay, less certain other ingredients present in minute quantity.

The Ash is China Clay and Sulphate of Lime

If it is already known that the ash contains these ingredients and no others, a simple analytical separation process suffices to determine the relative proportions.

The ash is digested at a gentle heat with weak hydrochloric acid. The sulphate of lime goes into solution and the clay remains insoluble. The clay is filtered off, ignited and weighed. The difference in weight between the original ignited ash and that of the insoluble clay represents the sulphate of lime.

If the nature of the ash is to some extent unknown, the procedure is different. Fusion of a weighed quantity of the ash with fusion mixture is resorted to as described in the first case. The clay is decomposed and its alumina content goes into solution, and also the sulphate of lime. The *silica* is removed as previously, the filtrate containing the alumina and calcium sulphate being made up to an exact known volume.

The alumina is determined in one-half the solution, and the lime in this same quantity.

The sulphate, or sulphuric acid in combination, is determined in the second half the solution by precipitation with barium chloride in acid solution. This throws down the sulphuric acid as barium sulphate, which is filtered off, washed and ignited. It is subsequently weighed and the sulphuric acid in combination calculated.

The Ash Contains Clay and Satin White

Here again, if it is known that the mineral residue contains these constituents, digestion with weak hydrochloric acid removes the satin white, leaving the China Clay as an insoluble residue which can be filtered off, dried and weighed. The difference represents satin white in an ignited condition, and can, if necessary, be calculated as a moist paste with a known percentage of moisture. The analysis along accurate methods requires the fusion process. Here the work is a little more complicated. The clay is decomposed into silica and alumina, while the satin white, consisting of calcium sulphate, traces possibly of lime, and precipitated alumina goes into solution. The latter therefore contains alumina from the clay, and alumina from the satin white. The correct proportions of alumina to be calculated to clay and satin white respectively are readily ascertained from the known facts as to the theoretical composition of clay.

Resistance Tests on Firebricks

Ground China Clay and Ball Clay Mixtures

IN the Journal of the American Ceramic Society, E. Sieurin and F. Carlsson (of the Höganäs Works, Sweden) report the results of resistance tests on firebricks under load at high temperatures. Mixtures of finely ground China Clay and ball clay (in equal parts) with the same amount of grog (produced by firing the same mixture at cone 14—about 1,410° C.) were made into 3 cm. cubes and subjected to a pressure of 2 kg. per sq. cm. at a temperature which sufficed to cause a linear contraction of 0·3 per cent. of the original length in 2 hours, such temperature being defined as the softening temperature. This clay mixture gave on analysis 54·52 per cent. silica, 43·04 alumina, 0·89 ferric oxide, 0·68 lime, and 0·78 potash (total, 99·91), and its fusion point was cone 34 (about 1,750° C.). Definite proportions of silica, alumina, ferric oxide, lime, and magnesia respectively were added to the raw mixture, and the fusion (deformation) and softening points were determined—in cones. In the case of silica the minimum softening temperature occurs with between 60 and 70 per cent. silica content, whereas the minimum cone melting point lies at about 90 per cent. silica content. With higher silica content the softening temperature rises rapidly, being about 1,650° C. for 95 per cent. silica (the usual average for silica bricks). In most cases a considerably lower softening temperature was observed with coarse-grained than with fine-grained material, owing to the presence of certain hollows which cause a more rapid contraction.

The Behaviour of Alumina

This was also found to be the case with addition of alumina. Increase of alumina causes a continuous rise of softening temperature (and also of cone melting point), though with very high alumina—about 80 per cent. or more—there is apparently a sudden fall, which is really a sudden collapse (mechanical failure), owing to lack of binding material. Even very small amounts of ferric oxide, lime, and magnesia caused considerable reduction in the resistance to pressure. An increase of ferric oxide from 0·89 to 1·53 per cent. caused a lowering of the softening temperature by 50° C., but further increase produces less effect, and the softening temperature is nearly constant between 6 and 12 per cent. ferric oxide, whilst still further increase causes more rapid fall.

Increase of lime from 0·68 to 0·79 per cent. caused the softening temperature to fall 25° C. As so small a proportion of lime produces such a marked effect, investigations are being made to ascertain the softening temperature with a lower lime content than 0·68 per cent. An increase of magnesia from 0 to 0·08 per cent. caused the softening temperature to fall from 1,280 to 1,240° C. With 1 per cent. magnesia the softening temperature was 1,220° C. for the fine-grained mixture, while 1 per cent. lime only reduced the softening temperature to 1,260° C. It is only in the case of ferric oxide that no great difference can be observed between coarse and fine grains. For many purposes clay firebricks must be replaced by more resistant materials, such as bricks made from silica, aluminous mixtures, and silicon carbide (carborundum, etc.).

The Chemistry of Colloidal China Clay

By Alfred B. Searle

This is the final instalment of the series of articles commenced in our March issue, dealing with colloidal clay in general and colloidal China Clay in particular.

IX

Composition of Colloidal Clay

THE precise composition of the colloidal matter in China Clay or in the sols or gels prepared from it is not known. The existence and properties of silica, alumina, ferric hydroxide, and of organic matter in the colloidal state are well known, but colloidal clay differs in several important respects from all of these. It bears a much closer resemblance to a hypothetical colloidal alumino-silicic acid gel, but no substance of this nature has yet been prepared which can be regarded as clay. A mutually precipitated product formed by mixing colloidal silica sol with colloidal alumina sol has many of the properties of a clay gel, but is different in one very important particular—namely, the decomposition of the silica-alumina product by hydrochloric acid which does not affect the clay. Even this difference may possibly be due to the great age of clays as compared with the freshly-made colloidal product.

There is the further difference that, according to Bragg's researches, even the finest China Clay gives an X-ray spectrum which shows it to be crystalline.

At present, therefore, the true nature of China Clay is not definitely known. It certainly appears to have many properties in common with many colloids, and can replace these for various purposes. Its behaviour when heated is in many ways peculiar, and corresponds both to a gel and also to a more definite chemical compound. At temperatures above 600° C., either alone or with various bases, it is decomposed, as is well known, but so far its decomposition products have not hitherto given as good clues to its chemical composition as could be desired.

X.

Uses of Colloidal China Clay

The principal uses of colloidal China Clay, as distinct from those of the ordinary commercial materials, are :

(*a.*) In the manufacture of *paper*, where the clay gel, mixed with another gel (size), covers the fibres of vegetable material which form the skeleton of the material and fill the intervening pores. The difference between the fine gel and the coarser commercial clay is well seen in the different uses made by the paper manufacturer of these two materials : the coarse is used for "loading" the paper, and is almost wholly a filler, though its partially colloidal nature is of value in reducing the amount of size which would otherwise be needed. The finer clay or gel is used for providing the "coating" which imparts a glossy surface to the paper. Paper manufacturers do not ask for colloidal clay, but use the finest qualities of China Clay. If they were able to obtain prepared colloidal China Clay at a suitable price it would suit their purpose much better. The clay manufacturer, on the other hand, would benefit by supplying a material made under accurately controlled conditions, and therefore capable of being made to specification.

(*b.*) In *pottery* manufacture, the colloidal properties of China Clay are of minor properties, as the plasticity of the material can usually be supplied by ball clay. In some branches of pottery and porcelain manufacture, however, it is essential to employ a China Clay possessing distinct plasticity, and other properties of a colloidal gel.

In the manufacture of ware by the process of casting (*i.e.*, by pouring a viscous colloidal sol highly charged with inert matter in suspension into a plaster mould) the colloidal properties of the material are very obviously used. In this case the peptization of the clay is effected precisely in the same manner as that of other colloids. (*See* Section IV.).

(*c.*) In the *textile industry*, China Clay is used for a similar purpose to that for which it is employed in paper-making, and must, therefore, possess similar properties, though usually to a smaller extent.

(*d.*) In the manufacture of *rubber goods* the clay gel acts as a "filler" or "cheapener," bearing a close resemblance in many of its properties to the rubber itself. Mixtures of China Clay gel and rubber rich in clay have been found to possess the same extensibility and resilience as the pure rubber, whereas if commercial China Clay is used these properties are seriously diminished. In the rubber industry the clay owes its value chiefly to its colloidal gel properties, and any means whereby these are increased and inert materials are removed greatly improves the clay. In the rubber industry both the sol and gel forms are important.

(*e.*) In the manufacture of *celluloid, papier-mache, linoleum, and other plastic materials*, colloidal clay gel has precisely the properties required for a filler, having many of the characteristics of the materials themselves, and is, therefore, very superior to "inert" fillers.

(*f.*) In *chemical and colour manufacture*, China Clay gel is valuable on account of its great fineness, which enables it to enter rapidly and completely into reaction, whilst its colloidal nature enables it to absorb the colour efficiently and uniformly. It also has remarkable "covering power." For these reasons it forms an admirable vehicle for many pigments.

It is largely used in the manufacture of *ultramarine blue*, in which it also forms part of the colouring agent.

(*g.*) In *wall plasters* and *distemper* China Clay gel has the advantage over commercial China Clay of greater fineness, adhesion, and covering power, as well as freedom from grit.

(*h.*) In *tooth-powders and pastes, toilet preparations, polishes, crayons* and other preparations of a "chalky" nature where an almost impalpable neutral powder is required, China Clay gel is almost ideal, especially as, by slightly heating, it can be made to possess almost any degree of inertness.

(*i.*) *As an absorbent for grease.* The clay gel is greatly superior to the commercial clay, because its absorbing power is directly dependent on its colloidal nature, any inert or non-colloidal material present being useless in this respect.

(*j.*) As a *clarifying agent* for turbid fluids, China Clay has long been known and appreciated. The specially prepared sol or gel is superior because in it every particle has its clarifying power or adsorbency developed to the utmost. It has been found to be particularly successful in the use of clays as clarifying agents in the treatment of slightly oily effluents of spinning works, wool-scouring plants, distilleries, tanneries, dye-works, glue factories, breweries, and other industries producing an effluent containing organic matter in a very finely-divided or colloidal state. The best results are obtained when the colloidal matter in the effluent carries a positive electric charge, as it is dissipated by the added colloidal matter bearing a negative charge. Domestic sewage, however, is not of this character, and, therefore, cannot be clarified in this manner.

(*k.*) In *soaps* clay has long been used us a "filler," but it is more than that, inasmuch as its colloidal properties enable it to absorb dirt of various kinds and so make it a valuable detergent. It is obvious that if the clay gel is substituted for the commercial clay, a great improvement would be effected because of the greater adsorbent power of the gel. This has been found by the late E. Weston to be the case.

The chief advantages claimed for colloidal clay soap are that it absorbs dirt and grease and removes them without any deleterious preparation, and that it is capable of removing unsaponfiable oily substances—a result which is not possible with the ordinary scouring media. It is stated to have a greater detergent power than ordinary soap, and its antiseptic properties may be of considerable value.

(*l.*) In *printers' ink* the China Clay gel acts as a useful diluent and adsorbent. It takes up the pigment in a perfectly uniform manner and does not in any way interfere with the spreading action of the ink on the platen nor with the sharpness of impression or drying properties of the ink.

(*m.*) In *leather manufacture* the clay sol has a great penetrating power and, therefore, acts very satisfactorily as a filler. As it is precipitated in the pores of the hide and not merely on the surface, it is superior to inert or non-colloidal material which has been tried for the same purpose.

(*n.*) Colloidal China Clay is a valuable *emulsifying agent*, though it is not necessary to use a very pure gel so long as the clay is sufficiently fine. This is due to the fact that whilst a gel is preferable, any inert powder which will make the interface between the two liquids to be emulsified sufficiently viscous will stabilise the emulsion.

XI.

Costs

The cost of producing a China Clay sol or gel is quite small if it forms part of the ordinary routine at a China Clay works. If commercial clay has to be purchased and converted into a sol or gel the cost is considerable. The difference is due to the fact that at the China Clay works the clay is obtained in the "drags" in the form of a crude and very dilute sol, which merely requires a very simple treatment in order to separate the suspended inert matter and to concentrate the colloidal particles. If a gel is to be made—and this is in most cases the most convenient form to transport—the process is carried one stage further, but the additional plant required is very small, and it is all of a nature well understood by the men engaged on the present works.

As the value of the carefully prepared sol and gel to the users is much greater than the clay now offered to them, the increased prices realised yield a very handsome return on the slight additional expenditure as well as on the money which will have to be spent on propaganda work in "educating" many prospective users so that they may realise the superiority of the specially prepared material.

A similar state of affairs is taking place in the lime industry, where the use of "hydrated lime" is rapidly replacing the crude lump or ground lime formerly sold. Users have found the hydrated product so superior for their purpose that they willingly pay a price for it which yields a handsome return to the manufacturers for the additional treatment necessary. The manufacturers in turn find that such treatment also enables them to make use of material which was otherwise only saleable at a low figure. It appears highly probable that equally beneficial results will follow the general production of high-quality sols and gels from China Clay.

XII.

Fine China Clay *v.* Clay Gel

It is easy to argue that the finer grades of commercial China Clay are equal in every respect to the gel prepared in the manner previously suggested, but such reasoning is fallacious. The finest particles in suspension when the clay is run into the settling pits undoubtedly contain almost all the active colloidal material in the rock from which it was obtained, but if such a fluid is examined with respect to its colloidal properties it will be found to be very crude and to contain much non-colloidal material.

As the chief value of any colloidal gel depends on its intrinsic properties and on the absence of any inert material, it is difficult to make any simple comparison between fine China Clay and the clay gel, as the former is so much inferior. This is easily shown by the use of both materials in a parallel set of tests in which they are used in the manufacture of rubber, paper, paint or other industries in which the colloidal nature of the material is the chief factor. In some purposes for which China Clay is used—*e.g.*, the manufacture of sulphate of alumina, alum and the like, or as a cheap filler where any fine inert powder is all that is required, there is very little to be gained by using a specially prepared gel. In such cases commercial China Clay is wholly satisfactory, but for the more refined uses only the gel form is really suitable.

It is unfortunate that this important distinction has been obscured by some China Clay manufacturers who have been shortsighted enough not to realise the great advantages—both financial and technical—which they could gain from the production of a material more in the nature of a "fine chemical."

XIII.

Warnings

Manufacturers contemplating the manufacture of "colloidal clay" should observe the following precautions :—

(*a.*) The manufacture of colloidal clay gels has been protected by patents so far as the use of certain chemicals is concerned. The general principles of preparation cannot be so protected, and the use of other very suitable chemicals is still available to the public, and cannot now be made the subject of valid patents. It is even open to question as to how far a valid patent can be obtained for the use of any chemical known to be similar in general behaviour to others, the use of which cannot be patented. Thus, it has long been known that the essential part of any chemical which can be used for this purpose is either a positively or negatively charged ion, according to the stage in the manufacture of the colloid. Consequently, as any substance containing such ions can be used, it is arguable that the Patent Laws cannot restrict the use of a selected number of such chemicals to any individuals.

(*b.*) The use of clay sols and gels in the manufacture of rubber and certain other materials has been protected by Patents which, so far as the author is aware, are perfectly valid whenever the term "colloidal" is applied to the clay. They do not affect the use of commercial China Clay for these purposes, and it is questionable whether they could prevent the use of a "purified" China Clay, if it were not specifically sold as "colloidal," because no protection is afforded by the Acts as between the use of a very pure and only a moderately pure material.

(*c.*) Several lots of so-called "colloidal clays" have been offered for sale which are very deficient in active colloidal properties. An examination of several of these made by the author showed that the chief defects are—(*i.*) imperfect peptisation, so that they contain much mica and other undesirable impurities, (ii.) imperfect or careless flocculation, whereby they contain free acid or salts of an objectionable character. (One large batch of paper was entirely spoiled by the use of such a clay containing free sulphuric acid which caused "charring"), (iii.) defective methods of drying, which resulted in the conversion of a large part of the clay gel into inert and irreversible material, and (iv.) a general character and properties which suggest that the material was the fine commercial China Clay which had only been treated in the manner customary in the ordinary China Clay works, and was "passed off" as colloidal clay.

It is a comparatively easy—though somewhat tedious—matter to determine the chief colloidal characteristics of a sample of so-called "colloidal clay," and firms who have been accustomed to the use of good materials will soon be aware if any other is substituted. The harm done in such a case is serious, but it is nothing compared to that which will result from the extensive supply of material which contains only a small proportion of active colloids. For this reason all interested in the use of China Clay for the purposes mentioned should spare no efforts to avoid the irretrievable loss of future trade which will inevitably follow attempts to pass off the finer grades of commercial China Clay as equal to the properly-made colloidal gel or the still more objectionable attempts to decry the advantages which result in the use of such gels for the purposes for which they are particularly suited. On the contrary, they should investigate the matter carefully, with such impartial technological assistance as they can obtain, in order to make the fullest use of their opportunities for supplying a material of the highest quality and one which can be used for many purposes for which commercial China Clay is only moderately suitable.

XIV.

Summary

China Clay is a relatively crude material notwithstanding the care taken in its manufacture. It contains a variable proportion of colloidal material in the form of a readily reversible *gel*. When this gel is separated by means of the usual methods employed in colloidal chemistry it is found to possess all the more important properties of the clay from which it was produced, together with others which were obscured by the impurities previously present. The clay gel is, therefore, superior for various commercial purposes for which China Clay has hitherto been used, and is applicable to other purposes with great advantage. Some of the uses and methods of preparation are protected by Patents, but apparently these do not affect the manufacture of clay gel by other equally suitable methods nor the use of the gel so prepared for any of the purposes mentioned in the foregoing pages.

Ball Clay in Canada

THE Canadian Department of Mines in their Summary Report of Investigations made by the Mines Branch, says :—

Professor W. G. Worcester, of the department of Ceramic Engineering, at the University of Saskatchewan, recently made tests on some ball clay beds, and the following is his report on a clay deposit near Willows :—

On Sec. 33, Tp. 7, R. 28, west of 2nd Mer., there is a section of clay approximately 30 feet in depth. The lower 10 feet is greyish white, somewhat stained with yellow along the cleavage lines. Close inspection reveals the presence of many minute iron concretions distributed throughout the mass.

The sample for this report was taken at an opening or cut from which two car loads of material had been taken for shipment to a brick plant a couple of years previous. Naturally a perfect sample could not be obtained due to cave-ins. The best average possible was taken, shipped to the ceramic laboratory at the University of Saskatchewan, where, up to the present, it has been tested as follows :—

Washing Test.

	p.c.
Caught on 40 mesh	1·10
,, 80 ,,	1·15
,, 100 ,,	0·03
,, 200 ,,	1·95
Total	4·23

The greater part of the residue caught on the screens is the iron in concretionary form, a little mica and some quartz grains.

The washed sample required 30 per cent. of water to produce plasticity.

The drying shrinkage was 7·4 per cent., the trials dried safely without warping or checking.

Burning Shrinkage.

	p.c.	p.c.
Cone 1 (2102 F)	5·9	total 13·3
,, 3 (2174 F)	6·8	,, 14·2
,, 5 (2246 F)	6·8	,, 14·2
,, 7 (2318 F)	7·6	,, 15·0

As a ball clay the above per cent. of shrinkages are normal and well within commercial limits.

As a comparison two greatly used ball clays are listed.

English ball clay No. 12	total	16·2
Tennessee ,, 7	,,	15·7

These clays were burned in the same kiln and at the same time as the Saskatchewan ball clay. Thus it can be seen that the latter falls in the same class, as far as shrinkage is concerned.

Burned Colour.

In order that the colour might be properly gauged or classed, samples of English and American commercial ball clays were obtained. Trial pieces were made of each and burned in the same kiln with the Saskatchewan clay. When cool and removed from the kiln the several samples were arranged according to their respective degrees of whiteness or tints, resulting as follows :—

Saskatchewan ball clay washed	1	best
Tennessee No 7 ball clay	2	next
,, ,, 9 ,, ,,	2	,,
Mayfield, Kentucky, ball clay	2	,,
Tennessee No. 11 ball clay	3	,,
English ,, 12 ,, ,,	4	,,
Saskatchewan ball clay unwashed	5	,,

In this test the Saskatchewan clay gave a better colour (light cream) than any of the imported standard clays. We can therefore say that it would prove highly suitable in the body mixtures for the manufacture of whiteware and porcelain.

Chemical Analysis.

That the chemical properties of the Saskatchewan clay may be compared with the better grades of commercial clays, the following table is given.

	Sask.	Mayfield, Ky.	S. Amboy, N.J.	Wareham, Eng.	Hall, Eng.
Silica	59·03	56·40	44·89	55·00	39·60
Alumina	25·88	30·00	37·27	29·71	45·00
Iron	0·94	—	0·97	2·14	—
Lime	0·24	0·40	0·41	0·62	0·10
Magnesia	3·23	5·27	0·19	3·44	3·30
Soda and potash	1·82		1·44		

It will be observed that the Saskatchewan clay corresponds quite closely with some of the best commercial ball clays of the world, and will, without a doubt, prove equally as good in actual use.

The deposit represented by the sample under test is directly alongside the Canadian Pacific Railway, and is four miles east of Willows station.

With the single exception, that of having to wash to remove the concretionary iron, the Saskatchewan ball clay is a valuable deposit. Its working properties are good and its burned or final colour ranks but very little below some of the China Clays of the world.

Unquestionably, Saskatchewan has a valuable resource in this deposit of material. However, it should be borne in mind that there are undoubtedly other deposits of similar properties and value at other points in the province, but studies of these deposits have not yet been made.

The above clay, however, ranks among the very best of its kind in the province, being up to commercial requirements, and situated close to rail facilities.

The Geology of China Clay

IN *Memoirs of the Geological Survey* in the Geological Survey Sheet relating to Cornwall, by Messrs. Usher, Barrow, MacAlister and Flett, published some time ago, the China Clay area, including the Hensbarrow district, is dealt with. The following review will be read with interest :—

In respect of the origin of "clay" and "stone" respectively, very little room is left for quarrel with the authors of the memoir, since each in his own section voices his own view, and, as the views are directly opposed in several cases, a student of these vexed questions can claim agreement with one or the other.

As to clay, Mr. MacAlister states (p. 115), "The origin of the China Clay rock is intimately bound up with the pneumatolytic conditions which prevailed after the consolidation of the granite. Examination shows that not only have some of the minerals of the original rock been broken down, but there has been a distinct addition of fluorine and boron, accompanied by hydration and the formation of secondary minerals."

Dr. Flett's view is as follows (p. 118) :—

"When kaolin is abundant in a granite there is often no special abundance of secondary white mica. The kaolin aggregates often contain a little muscovite, but this does not usually form a large portion of their mass. There is also no notable increase of Topay or of Tourmaline. These facts point to the probability that neither fluoric nor boric gases were the chief agencies in kaolinisation, and support Vogt's hypothesis that carbonic acid was the principal, though probably not the only, gas involved."

In which honest difference of opinion our own support would be to Mr. MacAlister.

Authors at Variance

The differences between the authors are less in the matter of "stone," and then we should agree with Dr. Flett. We would emphasise a point which does not appear in the memoir, that the highest priced China stone of the day is that in which practically no kaolinisation has occurred.

Throughout the work, in all the varied and interesting descriptions of contact and other alteration the word pneumatolysis constantly appears. It is probably too late to protest against the loose manner in which this term is now used in petrology, but students should be warned that "pneumatolysis" is not confined to the action of vapours and gases, but includes also changes in which thermal waters and fluids may play a principal part.

There are naturally points in the memoir with whichmany petrologists cannot find themselves in agreement, as instance the statement that the formation of brown Tourmaline at the expense of biotite is characteristic of the granite of the St. Austell area. Many of us have never been able to detect any convincing evidence that Tourmaline replaces biotite at any time. Others would strongly support the view advanced in the memoir. Such differences must be, and in no way detract from the value of an important and useful piece of geological survey. The very fact that the associated authors frankly differ shows a scientific spirit unhampered by official effort at uniformity and advances the standard of the work.

Summary of Countries Producing Kaolins

From Mr. J. Allen Howes's Handbook of Kaolins

Great Britain

True kaolins are found only in the counties of Cornwall and Devon. The plastic "Ball Clays" of the Bovey Basin and of the Poole district in Dorsetshire are employed in the manufacture of white wares but they are not to be confused with kaolin or china clay.

France

Deposits of kaolin occur in numerous districts in this country: Haute Vienne, Allier, Dordogne, Lot-et-Garonne, Nievre, Drome, Normandy, Brittany and the Pyrenees.

Germany and Austria

The kaolins of Germany are of great industrial importance, and geologically are of considerable interest for they are found in a variety of different circumstances and geological ages, and the problem of their mode of origin has given rise to a voluminous literature.

Kingdom of Saxony

The earliest known occurrence of China Clay in Europe was that of a district between Aue and Schneeberg in the Erzgebirge.

Czecho-Slovakia (Bohemia)

Between Schwarzbach and Budweis in the Bohmer Wald kaolin occurs associated with graphite apparently in much the same way as in the Passau district; the nature of the original rock is more obscure, but it was evidently very rich in felspar. It occurs in more workable masses and of better quality than at Passau, but as in that locality there are places where its quality is decreased by streaks of nontronite. The principal area of exploitation lies between Mugrau and Schwarzbach.

Roumania

At Muncel in the Bumbestilor plain according to Rosler aplite veins are seen to carry Kaolinisation into the surrounding schists. The formation is not worked.

Sweden

The kaolins of Sweden are found in a comparatively limited area in the northern part of the provinces of Scane (Scania), Southern Sweden. A large number of deposits occur scattered over a belt of country about 54 kilometres long, and from 11 to 16 kilometres broad. This belt has a south-west, north-easterly extension.

Denmark (Bornholm)

Kaolin is found in Bornholm at the foot of the granite plateau north-east of Ronne, by the two villages Rabekkeguard and Buskeguard.

The kaolinised material is a small and strictly localised part of the so-called "primary" granite which at this point is traversed by veins of pegmatite with large decomposed felspar crystals and by small veins of diabase much decomposed and clayey. Less completely kaolinised cores and patches of the granite occur here and there.

Spain

Kaolin bearing rocks are fairly abundant in Spain, but nowhere are they exploited on a large scale. Kaolins derived from pegmatites and other granitic rocks decomposed in situ occur most extensively in Galicia and in the mountain ranges of the central provinces. Sedimentary arkoses and felspathic sandstones of cretaceous age form an extensive belt in the southern Pyrenees and occur again in the central Levantine districts.

Portugal

Kaolin-bearing sandstones of Miocene age are recorded from the neighbourhood of Alemquer. The kaolin from the Vista Alegre in Val Rico, near Villa-de-Feira, is clean and white; it originates in a pegmatite vein. This material is employed for ceramic purposes for paper and for the clarification of wine. In Portugal the name tierra de vinos is often given to kaolin clays.

Italy

The kaolin industry of Italy is not well developed; many of the deposits that are worked yield material of only moderate quality, and the better sources of supply are frequently inconveniently situated with respect to the manufacturing centres so that the cost of transport militates against their employment. Probably an active search would reveal many more deposits than are at present known.

Russia

The most considerable deposits of kaolinic clays are those found covering a fairly large area in the Government of Ekaterinoslav in Southern Russia. These have been described in some detail by Prof. P. Zemjatschenski, through whose kindness specimens in the Museum of Practical Geology may be seen.

China

The raw materials of the porcelain industry of China naturally possess a peculiar interest. There seems to be some uncertainty as to the precise date when porcelain was first manufactured by the Chinese, but centuries before the first attempts were made in Europe the "china" wares which inspired the European potters' efforts were being made at various centres in China. These were situated in most cases at no great distance from the sources of the raw material and fuel. Some of the centres were situated in Kiangsi (with Ching-te-Chen the most renowned of the porcelain centres), Pechili, Kianguan, Shan-si, Shantung, Honan, Shen-si, Kansu (Chin-chou), Chehkiang, Ssuch'uan Fuhkien, Kuangtung, Hua-nan.

Japan

The porcelain clays of Japan were discovered many centuries later than those of China. The principal centre of the industry is Imari, the port of Arita, which occupies a position in Japan similar to that of Ching-te-Chen in China. Hither are brought china clay and china stone from the districts around.

India

High grade kaolin rocks are scarce in India, but in many places white clays derived from felspathic rock by their decomposition in situ, are found and worked for various purposes, usually on a very small scale.

The Federated Malay States

In the Federated Malay States kaolin occurs abundantly. (1) As a product of weathering rocks rich in alkali-felspar; (2) as a product of deep-seated changes generally ascribed to pneumatolitic action in an acid magma; and (3) in a remarkable state of purity as veins connected with granite masses and cutting older rocks.

Australia

Hitherto few occurrences of kaolin rock of serious commercial importance have been demonstrated in this region. So-called kaolins have been recorded from several places but exploitation has been spasmodic and little is really known about them. In association with metallic ores Kaolin material is not uncommon.

Canada

China clay is worked at only one spot in Canada, this is 7 miles from Huberdeau on the road to St. Remi, Amherst, about 40 miles north-west of Montreal, Quebec.

United States of America

The marketable kaolins of the United States are confined at present to the Eastern States, here they are fairly numerous and their importance and value is increasing. Their characters show a great range of variation, some are very

[*Continued on page* 14]

[*Continued from page* 11]

high-grade clays, but few, if any, have been found possessing the qualities peculiar to some of the best European kaolins.

White clays of several kinds are often styled kaolins in America, though they may not have the attributes of true kaolins but may be ball-clays, fire-clays, or clays more suitable for stoneware.

AFRICA

Kaolinised granitic rocks probably occur at many places in Africa, but none has so far been exploited for kaolin. In the Congo region highly kaolinised granite and gueiss are found at the surface and the kaolin washed therefrom has been employed by the natives as a whitewash.

Coating Machinery in America

Development due to China Clay Discovery

I HAVE been asked to say a few words on progress in the development of coating machinery, said Mr. W. H. Waldron (Vice-President of the John Waldron Co., of New Brunswick, N.J.) in the preface to a paper read before the joint meeting of superintendents and cost men at Halamazoo, Michigan, recently.

The first knowledge I have been able to gather from our old records of the coating of paper by machinery is the shipment of a grounding or coating machine in 1850 to one R. C. Barnes, for use in the making of wall paper. Four machines were built for the same purpose in 1851. Where the thought came from that created this machine I am unable to trace. Prior to that time the small quantities of coated papers produced in this country were doubtless generally made by hand.

These early machines were called Sun and Planet machines, as the colour was smoothed out by the action of four revolving flat brushes in the shape of a disc attached to the ends of a cross which also revolved on its own centre. These machines came into general use for applying the ground coat on wall papers in the new factories of the time.

Origin of Coated Papers

In 1852, a coating mill, still in active business, that was then making coloured papers by hand, heard of these machines and ordered one for the making of their product. It is probably the first instance in this country of the use of a coating machine in the industry you are connected with. Somewhat later their use crept into other coating mills, which for many years only made what are known as fancy papers.

The coated papermakers had but a very limited market for their product, and the growth in the use of these machines was very slow till the discovery was made that a China Clay coating on paper produced better results in the printing art for certain kinds of printing. That was probably within the past thirty-five years. It was the beginning of the large business in coated book and lithograph papers of to-day.

The use of coated papers for printing purposes soon caused a demand for papers coated on both sides, and a great advance was made in the art of making it by the invention of the double coater by C. M. Gage about thirty years ago.

Recent Developments

To come down to present times, within the past fifteen years the business has reached an importance where there has been a constantly increasing demand for better built machinery capable of greater speed, and a very marked growth in the width of sheet coated, by reason of the increase in size of printing presses and the necessity of reducing cost of production.

The demand for greater speed has been met by the use of warm air for heating and ventilating, this having replaced the use of steam pipes which not only had limitations in speed of drying unless abnormally long buildings were used, but were actually detrimental to the coated paper. A still later advance in this line is the conditioning of the paper before rolling it up, which puts a normal amount of moisture in it if overdried. These aids to the coating of paper have made it possible and worth while to build coating machines capable of higher speeds and greater widths than were practical before.

Wall papers are now coated up to 400 ft. a minute, and speeds in coating mills of 200 to 250 ft. a minute are not uncommon. This is perhaps double the average of only a few years ago. Coating machines running a sheet 96 in. wide, coating one side, are now in successful operation, and one coating both sides of an 82 in. sheet will soon be in use.

New Era for Coated Papers

There is no reason whatsoever, from a mechanical standpoint, why both the width and speed of double and single coating machines should not be increased still further. It is only a question of meeting simple mechanical requirements. The only limitation as to width being the width of sheet turned out by paper machine which produces the raw stock used, and speed within reason only means better, heavier machinery built to stand the strain. It is more of a question whether output desired warrants the plant to produce it than a mechanical problem.

The coating industry is still in its infancy. Far greater advances have been made in the past twenty-five years or less, than in the previous fifty years, and in the past year 96 in. coated board has been made most successfully as a continuous operation from beater engine to the finished calendered coated product cut in sheets ready for inspection and shipment. This is the greatest event in the history of coating. It may be that it is the beginning of a new era where large output is desirable at lowest possible cost.

One of the reasons that has militated to some extent against the production of better machinery has been the fact that up to within a comparatively recent period there was but little communication and exchange of thought between those in the business.

China Clay by Great Western Railway

IN that admirable journal, *The Great Western Railway Magazine*, we find the following information: Reverting to the month of May—the latest month covered by Table No. V., which gives the tonnages of the principal commodities originating on the Great Western Railway—it will be observed that, as compared with the corresponding month of last year, there were substantial increases in some of the traffics, notably clay (including China Clay), grain, every description of iron and steel, pig iron, and limestone. On the other hand, there were considerable decreases in stone for road-making, and pit-wood and mining timber. In considering these comparisons, it should not be overlooked that the month of May in the present year contained 26 working days, and last year 27 working days.

TABLE No. V.—SELECTED COMMODITIES ORIGINATING ON THE GREAT WESTERN RAILWAY.

Commodity.	March, 1923.	April, 1923.	May, 1923.	May, 1922.
	Tons.	Tons.	Tons.	Tons.
Bricks, common and fireclay ..	48,515	50,565	45,774	45,888
Cement	25,623	25,697	29,062	26,256
Clay (including China Clay)	71,483	81,326	86,997	72,467
Flour and bran, sharps and other flour-mill offal	45,660	40,678	41,504	45,352
Grain class	60,908	54,526	52,763	28,194
Hay, clover and straw	16,968	14,376	15,378	16,653
Iron and steel—				
Bars, joists and girder work ..	90,866	88,400	87,735	78,395
Blooms, billets and ingots	31,615	34,157	30,647	21,560
Plates	59,149	50,809	49,461	21,250
Scrap	87,833	83,047	88,555	63,031
E.o.h.p.	74,861	64,645	77,153	64,541
Iron, pig	20,218	22,341	26,565	19,755
Ironstone and iron ore	114,517	144,823	163,778	88,406
Limestone, other than for road-making or agricultural purposes ..	44,199	39,234	41,893	33,749
Manure	40,647	34,942	20,890	22,680
Oil cake and cattle foods	15,722	11,691	9,696	11,010
Oils and inflammable liquids ..	23,871	22,499	22,989	24,529
Stone for road-making purposes ..	171,828	158,845	188,103	220,395
Timber—				
Deals, battens and boards ..	18,985	15,859	19,327	18,184
Pitwood and mining	148,822	134,312	133,206	141,716
Groceries	32,819	33,314	37,176	36,813
No. of working days ..	27	26	26	27

Kaolin in Mexico

THE Mexican Government has made arrangements for working the numerous and extensive kaolin deposits existing in the country, which constitute an immense source of wealth. The most abundant are at Metepec and Zacatlan, in the State of Pueblo; Ixmiquilpapn, in Hidalgo; Salamanca and Silao, in Guanajato; Cerro de la Buffa, in Zacatecas; and San Juan, in Queretaro. Hitherto no attempt had been made to work these deposits, which contain an inexhaustible supply of materials for manufacture of the finest porcelain.—*Rassegna Minerarla*, June 15, 1923.

China Clay Notes and News

Publicity for China Clay

In an address at the St. Austell Rotary Club on August 8, Mr. S. P. Bunn, a Cornwall journalist, discussing the Press and its functions, said that recently an American papermaker in Boston, in an address to one of the American Papermakers' Associations, said there was nothing to touch English China Clays for papermaking, it being in colour, texture and freeness from grit and everything that made for a good bleaching and paper clay far superior to any of the clays produced in America. Had an American papermaker said that of American clays, there was not a papermaker or user of China Clay who would not have been made aware of it in a campaign of propaganda in the Press such as only Americans were capable of. The China Clay producers had given no publicity to that important tribute to their own product in American trade papers, in which producers of American clays were "boosting" their own clays to oust imported English clays. The China Clay Association stood almost alone as an Association in not giving publicity to their product as a standard article of commerce as distinct from individual firms advertising their own brands of it. Even in this country there was scope for more propaganda in the Press, and especially in the trade Press, as to the versatile attributes of China Clay, seeing that, while our consumption of newsprint was 450,000 tons per annum, we produced 300,000 tons only, leaving a balance of 150,000 to be imported.

China Clay and Coal Tar Colours

The capacity of China clay for absorbing, without any precipitating agency, coal tar colours is extensively utilised in manufacture of ordinary paints, particularly lime washes. The best results are obtained with basic coal tar colours, from the point of view of tone and fastness of the lakes. When the clay is levigated in contact with the coal tar solutions, the latter are usually immediately absorbed and so firmly fixed that they will resist the most powerful alkalies. Application of these lakes as lime colours is based upon this absorption. The silica in the clay is said to fix the colours owing to the formation of insoluble and double silicates.

The *modus operandi* is extremely simple. The China clay is mixed with water and then, while continually stirring, the colour solution is added until the required tint is obtained. For manufacture of lime colours only profitable on a large scale extensive plant is required. The clay used as carrier is levigated in large shallow square tanks, set in the ground, where the powdered material is worked into a firm paste with water. When the colour solution is added, the mass usually puffs out considerably so that often large quantities of water must be added, though excess must be avoided so that the consistency will be such as to allow of removal with a shovel, to be dried in the open air, or sheds, and then ground down in suitable mills.

Paper Sizing

Some fillers are known to have a decidedly injurious effect on the ink penetration, says an American paper-making expert. This is not necessarily due to any impurity, but it seems that a high percentage of filler loads the fibres with a substance which does not absorb the rosin size easily and so allows water or ink to penetrate. Filler should be added before the size and alum so that the coating may be as complete as possible, thus aiding the sizing and also the filler retention.

While there are conditions where high free rosin size gives superior results, it will generally be found that the lower free rosin or even neutral size is easier to use, especially with hard water, and it has the added conveniences that in many cases it can be used without emulsifying. If a very high free rosin size is used a good emulsifier must be used.

There should always be a very small excess of alum, and in most cases the alum should be added near the end and never to hot stock. Free acid from any source should be avoided.

Some fillers injure sizing, and care should be selected in choosing the type of filler to use, and in all cases it is better to add the filler before the rosin has been precipitated by the alum.

Preston China Clay Storage

In discussing, at the annual inspection by the Preston Corporation, the development of Preston port for the better accommodation of traffic, Mr. J. G. Merriweather, the traffic manager, said that both in wood pulp and China Clay, in which they were threatened with possible competition from Manchester and Fleetwood, the traders had expressed themselves as quite satisfied with the treatment they got at Preston and as to the manner in which their commodities were handled. It was absolutely essential, however, if they were to deal efficiently with the important traffic in China Clay, that the shed extension should be carried out, as was proposed by the committee, without delay.

Fuller's Earth in Cornwall

An important deposit of fuller's earth has been discovered in Cornwall, at Treamble, about 2½ miles from Perranporth, according to the *Western Morning News*, and already machinery is being installed to deal with the product, and the prospects are that it will prove a very profitable undertaking.

The deposit was discovered about two years ago by Mr. Stephen Clark, the owner of the Treamble estate. Opinions vary as to the amount of the deposit. One estimate is 1,000,000 tons. It has been proved in places to go 50 ft. deep, and consideration and study of the geological formation of the known depth of the Great Perran ironstone lode allows the assumption that the depth runs to far greater thickness than that at present proved.

The overburden covering the deposit is less than 4 ft. thick, and analytical chemists report the Treamble fuller's earth to be equal in quality and fineness to the best on the market. In its natural state it is a friable white clay, which washes down into an exceedingly white and finely-divided powder, so that it only needs a simple process of washing, settling, and drying before being marketable.

The fuller's earth, iron ore, and other minerals on the spot have been leased to a private limited company, Treamble Minerals, Ltd. The development of the property is proceeding apace, and the completion of the construction of the necessary machinery is contemplated two months hence. The earth is being brought in its raw state from the site by aerial ropeway to a mechanical mixer. From this it will pass in combination with a regular supply of water through launders and sieve arrangements to settling tanks. From thence it is to be conveyed to a mechanical dryer, where it is finished in powder form ready for despatch to the market.

This dryer is a patent furnace, the first of its kind to be installed in this country, and its use in connection with the drying of China Clay is under consideration by the great mid-Cornwall and Devon industry.

On Tuesday members of the holiday geological course of Camborne School of Mines, under Mr. E. H. Davison, visited the property and carried out a tour of inspection. Mr. Jenkins, one of the directors of the company, explained that they were handicapped by lack of railway facilities, but representations had been made to the Great Western Railway Co., and he had great hopes that they would result in the relaying of the Treamble line.

Mr. E. H. Davison said they had heard much of tin, copper, and iron, but fuller's earth in Cornwall was a new "stunt" altogether. Geologically speaking, the deposit of fuller's earth seemed one of very considerable extent. The analyses showed that it was of first-class quality, and the uses of a good, clean fuller's earth such as they had there were almost as numerous as those of China Clay. Mr. Stephen Clark, another of the directors, pointed out that when it was remembered that with fuller's earth the extraction was about 60 per cent. as against an average extraction of 20 per cent. in the case of China Clay, it would be realised that there were some grounds for optimism.

English China Clay Prices

China Clay, in bulk, f.o.b. Cornwall, 28s. 9d. to 71s. (highest grade) per ton. The extra charges (including filling) per ton for bags and casks are; Single bags, 9s. 6d.; double bags, 16s. 6d.; half-ton casks, 19s. 6d.; quarter-ton casks, 22s. 6d., in casks, with extra iron hoops, 2s. per ton extra.

The following are the prices of English China Clay in the United States:—

English clay, ex steamer, per ton	14.00 to 20.00
Domestic clay, washed, per ton	8.00 to 10.00
Domestic clay, unwashed—No. 1 per ton	6.00 to 7.20
No. 2	5.00 to 6.00

Industrial and Trade Reports

[From Our Own Correspondents and Other Sources]

Canada

The shipments of kaolin in 1921 were 124 tons, valued at $1,888, as compared with 683 tons, valued at $15,022 in 1920.

The present supply of China Clay in Canada is limited to one deposit, that of the Canadian China Clay Company, of Huberdeau, Quebec. This deposit is being developed by new mining methods, and a larger output of clay is promised than was formerly available.

There is a plentiful supply of high grade feldspar for pottery bodies and glazes in Eastern Canada. Any firm doing a large amount of business in white earthenware could purchase the crude feldspar and quartz from the mines, and do their own grinding.

Fuel.—As it requires six tons of coal to produce one ton of white table ware, the fuel question would have to be studied closely, and particular attention paid to design of kilns and method of fuel saving. Putting the coal through a gas producer and using the gas for fuel in a tunnel kiln seems to be the practice that is approved by most ceramic engineers.

Location.—The location for a plant making white table ware depends on various factors. The assembling of raw materials, the cheapest place to deliver coal, the transportation facilities for assembling and distribution, and the labour supply are the principal things to be taken into consideration.

Points on the St. Lawrence river up to Montreal have the advantage of ocean freight delivery of supplies of English China Clay and ball clay without re-handling, as well as access to the Nova Scotia coal fields. Points on Lake Erie, such as Port Stanley or Port Colborne, are well situated for receiving supplies of coal and fireclay from the United States, and points on the Welland Canal have similar advantages for assembling raw materials and distributing finished products.

The China Clay of Czecho-Slovakia

The most valuable pottery material is China Clay, which is one of the exports. It constitutes one of the most important aids in the development of the paper, porcelain and faïence industries. The largest pits are in the districts of Plzen, Podborany, Karlovy-Vary and W. Slovakia. The annual production is more than 20,000 wagons, 80 per cent. being exported; 75 per cent. to Germany, where China Clay is absolutely essential. The remainder goes to Austria, Poland, Jugo-Slavia, Magyarie, Switzerland, France, Italy. There are 30 large China Clay pits in Czecho-Slovakia and some hundreds of small. The chief competitor is English China Clay. There are 70 porcelain works, principally in the China Clay districts of W. Czecho-Slovakia. The annual production is 3,000 wagons, 70 per cent. of which are exported. Fancy porcelain goes chiefly to the United States, Great Britain, Germany, India, Italy and Jugo-Slavia; industrial porcelain to America, Italy, Switzerland, England, Germany, Rumania. The largest consumers are America and the Balkans, where there is competition with France and Germany.

The production of faïence is 2,000 waggons yearly. It is exported to the Balkans, Poland, France, Holland, Scandinavia, S. America, in competition with England and Germany.

Commercial Prospects for Georgia Clays

As the result of an investigation of the washing and utilization of Georgia clays, made by the Department of the Interior at the Ceramic Experiment Station of the Bureau of Mines, Columbus, Ohio, certain of these clays are being tried out commercially in the manufacture of refractories, floor tile, wall tile, face brick, and electrical porcelains. The results obtained in most cases have been quite encouraging. Other clays will be given commercial trials.

In the course of the experimental work at Columbus, a new system of washing has been devised which has proved very satisfactory in the separation of the desirable and undesirable portions of the clay. Data have been obtained on a large number of samples of Georgia clays as regards colour, shrinkage, fusibility, etc.

The Columbus station has been washing up to 500 pounds of certain of these clays which are later tested in the laboratory of the Tuscaloosa, Ala., station of the Bureau of Mines, and which will be tried out for use as filler material by commercial concerns. The mineral filler investigations have heretofore been conducted at the Tuscaloosa station, but will be transferred to the non-metallic experiment station established at Rutgers College and the State University of New Jersey, New Brunswick, N.J., by the Bureau of Mines, July 1.

This station will undertake the study of non-ceramic problems affecting the various non-metallic minerals. Essentially ceramic problems undertaken by the Bureau of Mines will in the future, as heretofore, be concentrated at the Columbus, Ohio, experiment station. Some ceramic work which has been under way at the Northwest station, Seattle, Wash., will, however, be continued there.

Commercial Intelligence

County Court Judgment

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.]

ANTIQUE GLAZED BRICK CO., LTD., North British Wharf, G.N. Goods Station, Wood Green, merchants. £34 16s. 10d. April 12.

Mortgages and Charges

*[NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]*

ALLEN AND SON (HALIFAX), LTD., glazed brick manufacturers.—Registered July 17, £15,000 debentures (secured by Trust Deed dated July 3, 1923); charged on properties at Hipperholme, etc., also general charge. *£7,450. December 31, 1922.

CENTRAL CORNWALL CHINA CLAY CO., LTD., St. Blazey.—Registered July 20, £3,200 debentures part of £25,000; general charge. *£17,750. December 31, 1922.

CROPPER (JAMES) AND CO., LTD., Burnside, paper manufacturers—Registered July 25, £15,000 debentures; general charge. *£14,600. May 24, 1923.

HEAD WEIR PAPER MILLS, LTD., Exeter.—Registered July 11, £22,154 mortgage, to E. S. and A. Robinson, Ltd., 1, Redcliffe Street, Bristol; charged on Head Weir Mills and Hutch Mills, Bonhay Road, Exeter, with plant, etc.

REED (ALBERT E.) AND CO., LTD., London, E.C., paper manufacturers.—Registered June 28, Trust Deed dated June 28, 1923, securing £300,000 debenture stock; charged on paper mills at Aylesford, etc., also general charge. *£100,000. January 5, 1923.

SKEGNESS BRICK AND TILE CO., LTD.—Registered June 6, £1,000 mortgage, to Mrs. M. Lill, 44, Queen Street, Market Rasen, and another; charged on properties, etc., at Winthorpe. *Nil. November 3, 1922.

Satisfactions

REED (ALBERT E.) AND CO., LTD., London, E.C., paper makers.—Satisfaction registered June 18, £100,000, registered July 6, 1903, and December 4, 1917.

ST. NEOTS PAPER MILL CO., LTD.—Satisfaction registered June 8, £8,000, registered March 17, 1922.

TOWN (JOSEPH) AND SONS, LTD., Leeds, paper manufacturers.—Satisfaction registered June 19, £24,000, registered April 26, 1906.

London Gazette

Company Winding Up

THE "BRIDGE" PAPER MILLS, LTD. Winding-up order made June 19.

Company Winding Up Voluntarily

CHINA CLAY CORPORATION, LTD. F. F. Fuller, 638, Salisbury House, London, E.C.2 appointed liquidator.

Shipping and Export News of the Month

We give below the latest particulars relating to arrivals and sailings of ships engaged in the China Clay Trade, at the principal British clay ports. Registered exports of China Clay with countries of destination, and other shipping and export matters are dealt with.

Shipping—Fowey, July, 1923

Arrived			Vessel's Name	Sailed	
July	1.	S.S.	*Mary Arston II*	July 4,	Gravesend
July	1.	S.S.	*Millocrat*	July 4,	Manchester
July	1.	M.V.	*Ingeborg*	July 4,	Ranmouth
July	2.	M.V.	*Leeuwerik*	July 4,	Kotka
July	2.	S.S.	*Dinorwic*	July 5,	Runcorn
July	3.	S.S.	*Falmouth Castle*	July 5,	Runcorn
July	3.	S.V.	*Norden*	July 13,	Odense
July	3.	S.S.	*Silva*	July 5,	Gothenburg
July	3.	S.S.	*Esther*	July 6,	Methil
July	3.	M.V.	*Mary Peers*	July 12,	Anvers
July	4.	S.S.	*Sojourner*	July 7,	Anvers
July	4.	S.S.	*Birjo Maru*	July 11,	Porland Me.
July	4.	S.S.	*Phœnix*	July 10,	Bo'ness
July	5.	S.S.	*Startforth*	July 10,	Anvers
July	6.	S.S.	*Dieux Freres*	July 11,	Brussels
July	6.	M.V.	*Katie*	July 14,	Mevagissey
July	6.	S.V.	*David Morris*	July 6,	Par
July	6.	S.S.	*Ualan*	July 11,	Brussels
July	6.	S.V.	*Atlantic*	*	
July	7.	S.V.	*Weser*	July 17,	Ghent
July	8.	S.S.	*Westdale*	July 11,	Ridham
July	8.	S.S.	*Tritonia*	July 16,	Philadelphia
July	8.	S.S.	*Holyhead*	July 10,	Liverpool
July	8.	S.V.	*Alert*	July 13,	Weston Point
July	8.	S.S.	*Rathlen Head*	July 23,	Philadelphia
July	9.	S.S.	*Cervantes*	July 13,	Genoa
July	9.	S.V.	*Amanda*	July 14,	Runcorn
July	9.	S.S.	*Camm*	July 12,	Gravesend
July	10.	S.S.	*Briar Rose*	July 13,	Preston
July	12.	S.S.	*Marnix*	July 17,	Brussels
July	12.	S.S.	*Moss Rose*	July 13,	Garston
July	12.	S.V.	*Rhoda Mary*	July 27,	London
July	12.	S.S.	*Spaarnestroom*	July 14,	Amsterdam
July	13.	S.S.	*Torfrey*	July 16,	Pasages
July	15.		*Manus*	July 23,	Riga
July	15.		*Flying Foam*	July 24,	Weston Point
July	15.	S.S.	*Falmouth Castle*	July 19,	Runcorn
July	16.	S.S.	*Seaforth*	July 20,	Anvers
July	17.	S.S.	*Mersey*	July 18,	Ridham
July	17.	M.V.	*Katie*	July 21,	Rochester
July	18.	S.S.	*Condor*	July 21,	Rouen
July	18.	S.S.	*Pansy*	July 21,	Preston
July	18.	M.V.	*Lydia Cardell*	*	
July	18.	S.S.	*Edern*	July 23,	Ridham
July	21.	M.V.	*Agathe*	July 27,	Hamburg
July	21.	M.V.	*Sampo*	July 27,	Helsingborg
July	22.	S.S.	*Elina*	July 26,	Antwerp
July	22.	S.S.	*Ciscar*	July 25,	Genoa
July	22.	S.V.	*Jane Slade*	*	
July	23.	S.S.	*Fox*	July 26,	Gravelines
July	23.	S.S.	*Mersey*	July 24,	Larne
July	23.	M.V.	*Jupiter*	July 25,	Odense
July	24.	M.V.	*Alfa*	July 26,	Bo'ness
July	24.	S.S.	*Ferrun*	July 26,	Lancaster
July	24.	M.V.	*Grosholm*	Aug. 3,	Botwood
July	25.	S.S.	*Royal Firth*	July 28,	Anvers
July	25.	S.V.	*Vadder Vietor*	Aug. 3,	Hamburg
July	25.	S.S.	*Birmingham*	July 26,	Liverpool
July	25.	S.V.	*Olive Branch*	*	
July	25.	S.S.	*Briar Rose*	July 27,	Preston
July	26.	S.S.	*Irena*	July 30,	Lancaster
July	27.	S.V.	*John Farley*	Aug. 7,	Garston
July	27.	S.S.	*Falmouth Castle*	July 31,	Runcorn
July	28.	S.S.	*Dunleith*	Aug. 1,	Liverpool
July	29.	S.S.	*Olive*	Aug. 1,	Weston Point
July	29.	S.S.	*Ualan*	Aug. 3,	Brussels
July	29.	S.S.	*Ohio Maru*	Aug. 9,	Baltimore
July	29.	S.S.	*Cliffmore*	Aug. 1,	Gravesend
July	30.	S.V.	*Alice Williams*	Aug. 7,	London
July	30.	S.S.	*Coniston*	Aug. 2,	Anvers
July	31.	S.S.	*Seaforth*	Aug. 4,	Anvers

* In port.

Exports of China Clay

THE exports of China Clay (including Cornish or China Stone) for the month of July, 1923, were 26,371 tons, valued at £62,999. The figures for July, 1922, were 54,135 tons and £135,916 respectively.

Par Harbour Shipping—July, 1923

Arrivals

Date.		Vessel's Name.	From.
July	3, S.S.	*Robrix*	Truro
July	5, S.V.	*Yealm*	Plymouth
July	5, S.V.	*Edith*	Plymouth
July	6, S.V.	*Gwendoline*	Plymouth
July	6, S.V.	*Alzina*	Plymouth
July	6, S.V.	*David Morris*	Exeter
July	8, S.V.	*Mary Edwards*	Truro
July	10, M.V.	*Schwan*	Penrhyn
July	11, S.V.	*Hero*	Caverack
July	11, S.V.	*Triumph*	Plymouth
July	11, S.V.	*Rosina*	Llanelly
July	11, S.V.	*Snowflake*	Runcorn
July	12, S.V.	*Yealm*	Plymouth
July	12, S.V.	*Guiding Star*	Port Navis
July	15, S.S.	*Stav*	Plymouth
July	15, M.V.	*Haldon*	Barry
July	16, S.V.	*Pet*	Runcorn
July	17, S.V.	*Dundarg*	Falmouth
July	17, S.V.	*Lucy Richmond*	Falmouth
July	18, S.S.	*Norrix*	Exeter
July	22, S.V.	*Glenwood*	Exeter
July	22, S.V.	*Success*	Plymouth
Jan.	25, S.V.	*J. H. Barrow*	Fowey
Mch.	23, S.V.	*Alice Williams*	Penzance
July	26, S.S.	*Loch Leven*	Cardiff
July	27, M.V.	*Isabel*	Port Leven

Sailings

Date.		Vessel's Name.	Destination.
July	5, S.S.	*Robrix*	Ghent
July	4, S.V.	*Rothersand*	London
July	4, M.S.	*Csardas*	Newlyn
July	7, S.V.	*Yealm*	Plymouth
July	10, S.V.	*Edith*	Pentewan
July	10, S.V.	*Gwendoline*	Pentewan
July	10, S.V.	*Alzina*	Pentewan
July	12, M.V.	*Schwan*	Inverkiething
July	13, S.V.	*Triumph*	Plymouth
July	14, S.V.	*Mary Edwards*	Grimsby
July	14, S.V.	*Yealm*	Pentewan
July	17, S.V.	*Hero*	Runcorn
July	17, S.S.	*Stav*	Preston
July	18, S.V.	*Rosina*	Queenborough
July	18, S.V.	*Snowflake*	Runcorn
July	18, S.V.	*Guiding Star*	Runcorn
July	18, S.S.	*Norrix*	Gravesend
July	18, M.V.	*Haldon*	Runcorn
July	18, S.V.	*Dundarg*	Leith
July	23, S.V.	*Lucy Richmond*	Dunkirk
July	26, S.V.	*Glenwood*	Queenborough
July	26, S.V.	*Success*	Plymouth
July	27, S.V.	*Pet*	Runcorn
July	27, S.V.	*J. H. Barrow*	London
July	28, S.V.	*Loch Leven*	Londonderry
July	30,	*Alice Williams*	Fowey

Charlestown Shipping—July, 1923

Arrivals

Date	Name of Vessel	From
June 30.	*Mary Peers*	Hayle
July 3.	*Berthe*	Bordeaux
July 5.	*Henrietta*	Truro
July 7.	*Rosalell*	Falmouth
July 8.	*Hannah*	Plymouth
July 9.	*Matilda*	Mevagissey
July 13.	*Bijou*	Penrhyn
July 14.	*Shellie*	Cork
July 19.	*Trader*	Coursealles
July 19.	*Miriam*	Dartmouth
July 21.	*Two Sisters*	Truro
July 25.	*Warita*	Cork
July 27.	*Alder*	St. Brieux
July 27.	*Garthaven*	Penrhyn
July 27.	*Moulheron*	Plymouth
July 30.	*T. P. Tilling*	Rouen

Sailings

Date	Name of Vessel	Destination
June 30.	*Lady Rosebery*	Rochester
June 30.	*Ox Bird*	London
July 2.	*Madeleine*	Nantes
July 6.	*Henrietta*	Liverpool
July 10.	*Rosabell*	Liverpool
July 11.	*Hannah*	Liverpool
July 14.	*Berthe*	Nantes
July 14.	*Matilda*	Runcorn
July 16.	*Rose*	London
July 17.	*Shellie*	Barrow
July 19.	*Trader*	Brussels
July 20.	*Miriam*	Preston
July 26.	*Two Sisters*	London
July 26.	*Warita*	Preston
July 28.	*Alder*	Manchester
July 28.	*Garthaven*	Runcorn
July 28.	*Moulheron*	Boulogne
July 30.	*T. P. Tilling*	Preston

Par Harbour Tide Table, August, 1923

(British Summer Time throughout.)

Day of Week.	Day of Month.	Morning.	Afternoon.	Height.
Wednesday	1	9.4	9.21	12.3
Thursday	2	9.38	9.55	11.8
Friday	3	10.13	10.31	11.1
Saturday	4	10.50	11.10	10.5
SUNDAY	5	11.33	11.59	9.11
Monday	6	—	0.29	9.6
Tuesday	7	1.3	1.39	9.6
Wednesday	8	2.17	2.55	9.11
Thursday	9	3.31	4.3	10.8
Friday	10	4.32	4.57	11.5
Saturday	11	5.21	5.46	12.3
SUNDAY	12	6.8	6.30	12.10
Monday	13	6.51	7.12	13.1
Tuesday	14	7.33	7.53	13.5
Wednesday	15	8.12	8.31	13.6
Thursday	16	8.51	9.12	13.4
Friday	17	9.33	9.54	12.10
Saturday	18	10.16	10.39	12.2
SUNDAY	19	11.4	11.31	11.4
Monday	20	—	0.2	10.8
Tuesday	21	0.37	1.18	10.4
Wednesday	22	2.1	2.44	10.8
Thursday	23	3.23	3.59	11.3
Friday	24	4.21	5.0	11.11
Saturday	25	5.27	5.52	12.6
SUNDAY	26	6.15	6.36	12.10
Monday	27	6.55	7.13	13.0
Tuesday	28	7.30	7.47	13.1
Wednesday	29	8.3	8.18	12.10
Thursday	30	8.34	8.50	12.6
Friday	31	9.05	9.20	12.0

H. L. VICARY, Harbour Master.

Arrivals of China Clay in Antwerp and Brussels

WE give below particulars of arrivals of China Clay in the port of Antwerp and Brussels during the month of July :—

From				
Poole	B.	*Hebe*	350	tons
Poole	B.	*Thistle*	140	,,
Poole	B.	*Wolsey*	150	,,
Fowey	M.S.	*Rognlund*	496	,,
Teignmouth	M.S.	*Record Reign*	270	,,
Teignmouth	S.S.	*Alkmaar*	210	,,
Teignmouth	M.S.	*Airston*	150	,,
Poole	SLP.	*Tintara*	145	,,
Poole	KTCH.	*Kate*	135	,,
Fowey	M.S.	*Mary Peers*	229	,,
Fremington	S.S.	*Orleich*	580	,,
Bideford	M.S.	*Mayals*	350	,,
Charlestown	B.	*Bijou*	53	,,
			200	bags
Fowey	S.S.	*Seaforth*	296	tons
			100	bags
Teignmouth	SCH.	*Carmenta*	284	tons
Fowey (to Brussels)	S.S.	*Marnix*	650	,,
Fowey (to Ghent)	S.V.	*Weser*	299	,,
Poole	B.	*Dominion*	180	,,
Teignmouth	KTCH.	*Young Fox*	160	tons
Plymouth	SCH.	*M. A. James*	220	,,
Bideford	SCH.	*Emma Ester*	188	,,
Fowey	S.S.	*Elina*	750	,,
Fremington	S.S.	*Orenie*	573	,,
Fowey	S.S.	*Royal Firth*	420	,,
Teignmouth	SCH.	*Duchess*	282	,,
Fowey	S.S.	*Elina*	751	,,

China Clay July Deliveries

Falling Off of Exports

THERE was a falling off of deliveries of China Clay during July, the drop being accounted for by Fowey, whose shipments dropped from 56,751 to 48,680 in June. This has been partly due to a paucity of orders on export account and partly to the lessened facilities that were available during July on account of one jetty having been closed down for repairs and the electric mechanical jetty having been out of service for a week.

Steamers and schooners that have loaded at the jetties during the month totalled 68. The Japanese steamship *Bijo Maru* took 7,000 tons to Portland, Maine ; the British steamship *Tritonia* 6,000 tons to Philadelphia ; and the *Rathlin Head*, another British steamship, 7,000 tons to the same port. Other cargoes were 1,500 tons to Genoa by the British s.s. *Ciscar*, 600 tons to Amsterdam by the Dutch s.s. *Spaarnestroom*, and 2,600 tons to Botwood, Newfoundland, by the Norwegian auxiliary barque *Grosholm*.

The total of exports returned for July, which are included in the total deliveries given below, was 26,371, against 54,135 in July last year, and 14,484 in July, 1921. Details for the month are :—

Port.	Tonnage.
Fowey	48,680
Charlestown	4,339
Par	3,563
Plymouth	545
	57,127
By rail throughout	4,976
Total	62,103

Against 71,347 for June.

The Behaviour of Lake Pigments

LAKE pigments are generally employed in the manufacture of coloured surface papers. They are prepared by precipitating the artificial dyestuffs as insoluble compounds upon a finely divided substratum, which in the case of coated papers may be either china clay, blanc fixe, or satin white. The precipitating agent varies with the character of the dyestuff, acid dyes being precipitated with barium chloride or soluble lead salts, with which they form insoluble compounds, while for basic dyes tannin is the typical precipitant. The substratum may be ready prepared or may be produced simultaneously along with the lake, as by the interaction of barium chloride and aluminium sulphate. Lakes are also manufactured by the mutual precipitation of basic and acid dyestuffs.

A method of precipitating dyestuffs is carried out by the use of rosin soap, prepared according to one formula by heating four parts by weight of powdered rosin with one part of calcined soda dissolved in eight parts of water. In the employment of rosin size complete precipitation only takes place on the further addition of alum or zinc sulphate. The process has the further objection that frothing is apt to be troublesome, and the lakes produced, although brilliant, are very fugitive.

In the case of acid dyestuffs an 18 per cent. solution of aluminium sulphate is mixed, while stirring, with the dyestuff dissolved in 25 to 30 times its weight in water, and barium chloride added, or blanc fixe or satin white themselves are first made into a paste with the dye, and the mixture diluted and precipitated with barium chloride. Alumina is frequently used in combination with the base in lake formation, as it adds fastness by fixing the colour. It is usually prepared *in situ* by the interaction of aluminium sulphate and calcined soda.

The China Clay Trade Review

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Contents

An Expanding Industry

IN spite of the loss of two large markets in Germany and Russia, the China Clay trade has steadily increased this year, and some day (possibly sooner than some prophets would have us believe), when these two countries are once more in the market, the production and export of the "White Wealth of the West" should be increased beyond all previous periods. One result of the world-war has been that America and other countries have tried to utilise their domestic clay; but good articles cannot be manufactured out of inferior raw materials, thus Cornish and Devon clays have once more come into their own. As with all successful and growing industries, a host of new companies are ready to offer shares to the public in China Clay speculations in various parts of the world, and a word of warning to our readers may not be out of place.

Whilst we welcome enquiries at these offices on all matters appertaining to the trade, we confess we are sometimes surprised at the propositions put up by men with no knowledge of the trade—company promoters and others who have discovered or are interested in land containing China Clay of sorts, often situated in some outlandish part of the world, miles from any rail or seaboard. Their one idea seems to be to get into touch with some reputable member of the English trade and obtain his signature to a prospectus. That such gentlemen are not "bitten" goes without saying, but we often wonder if any of these prospective companies see the light of day, and how much money may be lost in such speculations. By this we do not mean to say that there are not valuable deposits of China Clay in many parts of the world, some of which with experienced men might be worked profitably, but even with the best of them the greatest caution is needed, especially in times such as the present, when the finest Cornish and Devon clays can supply the world

Much money has been lost in the past in China Clay works, and our advice to all who contemplate investing in a China Clay proposition, either at home or abroad, is to look well for the names of the practical men behind the scheme. If these are lacking, war saving certificates will give them a better rate of interest on their money. It is a popular, though mistaken idea, that a China Clay works is an easy and profitable proposition. Nothing could be further from the truth. Although men have come into the industry who were not "born" into it, and have "made good," they are the exception, rather than the rule, and have been business men of outstanding ability. We desire to bring these remarks home very strongly to our readers, because we are firm believers in the future prosperity of the industry, and desire to see it in the hands of capable and practical men. The Producers' Association has done much to help and foster the trade. It is to be hoped that they will do all in their power to keep out the mere speculator, so that the industry may go forward in the future with as fair a name as in the past.

China Clay Exports

THERE has recently been a very serious falling off in the China Clay export trade, especially in July, mainly on account of fewer large shipments to America. This is looked upon as only a temporary lull in the steady growth of trade, which, up to the end of June, had been really remarkable. Political crises in America effect trade much more quickly than they do in this country, and the change in the presidency has had the tendency to influence those engaged in the import trade to hold their hands until it is seen what the policy of the new president will be. This change-over in America has had some detrimental effect upon the China Clay business, but it is not expected to be lasting.

Markets for China Clay on the Continent are still numerous, though not large, there being a distinct reluctance in making big purchases owing to the uncertainty of the political situation. It is some consolation to the producers to know that their markets are being kept open, even to such a limited extent.

Though there was such a drop in the quantity of China Clay exported in July, every country with which we are accustomed to trade was represented in the export list. One cargo was even sent to North Russia, and Germany took two. The heavy depression in the Belgian and French francs during the past month or two has operated very much against our China Clay business and is throwing our customers in those countries into the hands of sellers of foreign clays. The China Clay producers therefore have a very serious interest in the trend of political events across the water.

The busy time that has been experienced in the industry this year has been a decided fillip to employment, there being few China Clay workers formerly engaged in the industry who are not now employed. There are, however, still a good number of men unemployed in the China Clay district, mainly composed of young men who have reached employable age since the war, and of others who have been attracted to the district by the Rural District Council's unemployed schemes, or in the hope of getting employment in the China Clay works. Many of the young men are seeking an outlet via emigration.

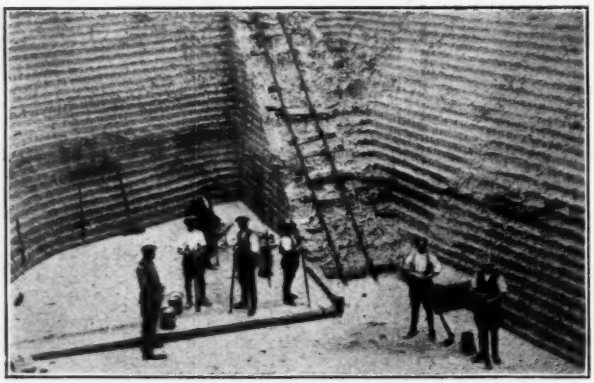
All the China Clay works engaged in the production of China Clay previous to the slump have now resumed production operations, having disposed of their old stocks. The greatest activity has been shown in the erection of new dries in all parts of the China Clay district, producers being anxious to increase their drying capacity so as to entitle them to an increased quota, their sales being based on dry capacity. Though the demand has been so good for China Clay this year—over 150,000 tons more than

for the corresponding period last year—there is still a considerable excess production over demand, making it imperative that old markets should be expanded and new ones found. The producers are anxiously awaiting the settlement of the European deadlock to achieve this.

A North Devon Ball Clay Works

" So that is Ball Clay is it ? Looks like chocolate. That blue-grey stuff looks like clay, but the other, well, if you cut it into little squares and wrapped it in silver paper, could be sold to sweet shops. But why do they call it Ball Clay ? Do you make billiard balls or something out of it ? Is it washed like China Clay, and what does it ' fire ' like ? " And so on *ad infinitum*.

In this case our visitor was a China Clay producer who had heard that there was such a thing as Ball Clay, and that's about all. We showed him a bit of the " chocolate " after it



SHOWING THE MAIN BALL CLAY PIT.

had been " fired "—clean, white and strong, more nearly white than many China Clays after " firing "—also a bit of the blue-grey clay which had been put through the " oven," and came out looking quite as white as the other. It was obvious that he was rather sceptical of our veracity. It wasn't easy to believe that a thousand to eleven hundred degrees of heat could turn that chocolate stuff into a pretty cream-white bar. It wasn't so hard to understand that the blue-grey clay would " fire out " white. It hadn't so far to go, as it were, but as for the " chocolate," well, he'd take that with a grain of salt—two grains, perhaps.

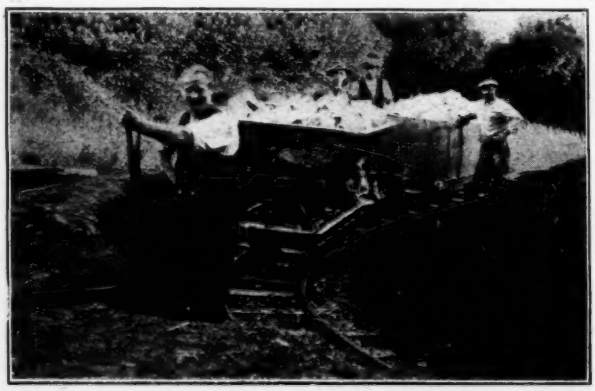
It is surprising how few China Clay people know what Ball Clay is and what it is used for. We had an amusing bit of correspondence recently with a firm who sold China Clays, and knew that China Clay is sometimes " blued " artificially. We sent them a sample of our " Blue " Ball Clay, and they wrote us to say that the clay was " obviously blued." They meant, of course, that it was artificially blued, which is quite impossible in the case of a Ball Clay, as the clay is sold just as it is dug out of the ground. The criticism, intended to be adverse, was really quite the opposite, without the critic knowing it. The " Blue " Ball Clay on our Woolladon Moors is really a very beautiful blue in its natural state.

The China Clay man who was so interested in our Ball Clay samples was told that it wasn't called Ball Clay because they made " billiard balls or something out of it." We are afraid that Smith or Newman would make very few three-figure breaks if they played with balls made from this or any other clay. Nor would Mr. Roger Wethered or Arthur Havers be the long drivers they are if they had to play with golf balls which had Ball Clay as an ingredient. The explanation is simple. The rectangular blocks into which the clay is cut when being taken from the ground are called " balls," although they are as near the shape of a ball as a cardboard box is the shape of an orange.

Our visitor was so interested in Ball Clay that we took him to our works near Meeth, and showed him our 1,500 acres from which we get the " black " clay which he thought was chololate and the " blue " clay which is so truly blue, just in this small section of Devon. He saw a dozen motor lorries in a more or less endless chain coming alongside the loading gantry, each in its turn to be filled with clay, which was taken a good ten miles into Okehampton or Torrington for shipment to the Staffordshire Potteries, or abroad to the Continent or America. The day our friend was there were were loading a cargo of 570 tons at Fremington, the lorries going from the works to the railway at Torrington, ten miles to the north and ten miles back, a steady stream of lorries all day and, in a pinch, all night as well. Never did a clay-producing company need a railway more than the Meeth (North Devon) Clay Co., Ltd. Like the Americans, we enjoyed " splendid isolation," said our friend.

And then we showed him where the new North Devon and Cornwall Junction Railway, referred to locally as the Torrington-Halwill Railway, would cross our 1,500 acres in about six months' time, and where our siding would be located just across the valley. The laying down of this railway, which will prove of inestimable benefit to a district which has been one of the most remote, isolated and inaccessible in the whole of England, will open up one of the largest tracts of ball clay bearing land in Devon, the county which yields the cream of the ball clay used all over the civilised world. The railway is well on its way to completion, and it is hoped that another six months will see it finished. Over part of the route the narrow-gauge line of the North Devon Clay Co., Ltd., from their works to Torrington is being reconstructed into a full gauge line, and will become part of the new railway. The cutting from Halwill Junction towards Highampton has been completed. Earthworks and cuttings have been made at Holsworthy Moor Bridge, and the culvert for the stream has been completed. Work is also proceeding at Friar's Hill, where the main road from Hatherleigh to Meeth and Petrockstow has been spanned by a bridge. A new bridge has been built across the River Torridge, and at the Torrington end of the line excavations have been completed to cross the road and join the London and South-Western Line. There is a big cutting about 3½ miles from Torrington. The contractors, Sir John Anderson's Company, have several gangs of men at work at different points along the line, labour being drawn from the unemployed in the district in accordance with the Government stipulations, when the grant of £125,000 towards the cost of the line was made. The new line will be worked by the London and South Western Company.

We hope to have something more to say about the Ball Clay Industry in our next issue.



BRINGING UP BALL CLAY FOR SHIPMENT AT THE MEETH (NORTH DEVON) CLAY CO.'S WORKS.

Centrifugal Separators' China Clay

AT the third annual general meeting of Centrifugal Separators, Ltd., held in London recently, the chairman, Sir Arthur Trevor Dawson, Bart., said that the China Clay Co., in which they were large shareholders, had since last year been manufacturing and selling China Clay of a high quality. The clay which had been manufactured had been made by the Gee machines, and it was of a quality equal, if not superior, to the best China Clay upon the market.

Improved China Clay Filter-Press

Translated from Revue des Materiaux de Construction July, 1923

When a question of drying large quantities of paste such as China Clay from the pits, after purification by levigation, the machine employed in industry is often the filter-press. This is an intermittent apparatus which involves a great deal of labour and gives a relatively poor yield.

A machine with 15 to 50 plates, 17½ in. to 19½ in. in diameter, produces 330 lb. to 1,100 lb. of dry clay per day when very plastic, to filter under heavy pressure in thin cakes, and up to about 3 tons with a thin China Clay paste.

We can at once see the principle of the machine. Compression, in spaces enclosed by filtering cloths, of the clay to be dried does not admit of continuous work, because when filtration is finished the different compartments must be opened to extract the clay. Continuity must be sought for on another principle.

In order to synchronise the operations—intake of clay, drying by absorption, and removal of the dry clay—it is necessary to have a hollow drum, with a depression inside and clay on the exterior. The surface of the drum being perforated and covered with a filtering cloth, the whole rotates in a vat containing the clay, not completely immersed, so that drying will take place in the part not immersed and the clay can be taken from the cloth before the lather returns to the wet material. There must be a discharging device, which is usually in form of a scraper, working of which is facilitated by stopping suction at the time of scraping, and, on the contrary, blowing a little compressed air inside under the cloth. This is the rotary vacuum filter working continuously. In practice, especially with more or less clayey carbotines, the production is not very good.

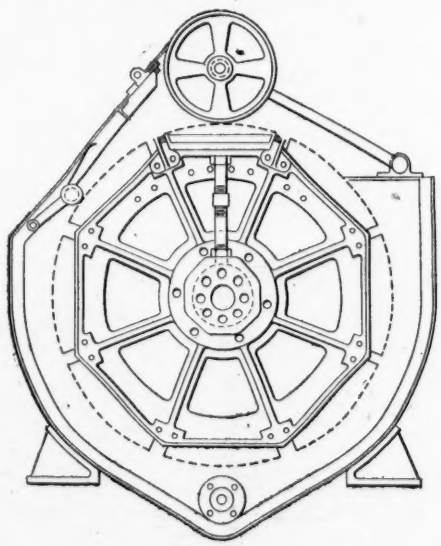


Fig. I.—Filtering Drum

The filtering drum is but slightly immersed in the wet clay, otherwise the product would be an insufficiently dry mud. Then the scraper, even when aided by compressed air, is a cause of wear of the cloths and decrease of their filtering surface. Working, even when continuous, does not give a constant yield, which decreases as work goes on. As soon as the cloth is torn there is a somewhat lengthy stoppage to change the old cloth for a new. It is usually stitched and fixed with wire, and consequently the wire must be unwound, the stitches taken out, the old cloth removed for the new one, which must be stitched and wound with wire, to be again set working. It must be noted that a single tear makes a cloth useless because if repaired filtration would be defective, and there would be more tearing. Thus the reason why these machines have not been more extensively adopted in industry is explained.

However, a recently-invented apparatus remedies, by means of an ingenious device, the inconveniences of rotary filters. This is the Hertenbein filter, of which we give the essential features.

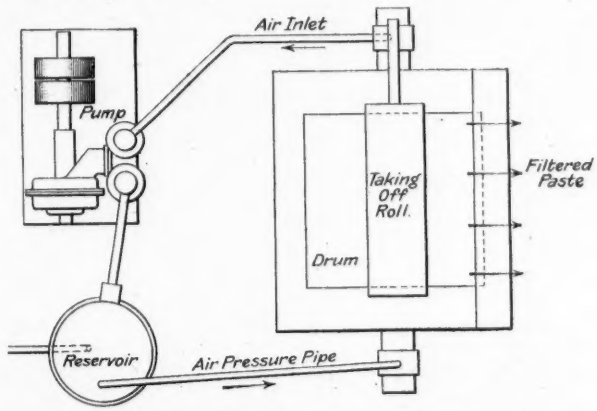


Fig. II.—Filter with Accessories

The filtering drum, cylindrical in form, is divided on the exterior into eight parts, on each of which there is a box with a flat bottom and convex exterior. These eight boxes mounted on the frame of the drum form the perfect cylinder. They are quite independent one of the other and are interchangeable. The exterior part of the box is perforated and covered with a filtering cloth secured to it by a simple and quickly-fastened device. An empty space between the box and frame on which it rests makes it possible to secure the cloths by pushing little fixing rods into these spaces.

The flat under part, turned towards the inside of the drum, is perforated with two holes for pipes, one for compressed air and the other to make a vacuum. These two pipes communicate with the axis of the drum, which produces, according to the position of the boxes in rotation, suction or compression, which can be regulated so as to be in advance of or behind the rotary motion. The drum rotates, immersed 11/16 in. in the clay in the vat. The taking-off device is a roll at the upper part, at a tangent with the cylinder and rotating on its axis with the same peripheric speed. Fig. 1 gives these arrangements and shows the working. When one of the boxes of the revolving drum enters the liquid clay the surface of the cloth has its maximum filtering power, as we shall see, at the end of the cycle. Suction begins in each box when about to enter the clay. As the water is gradually sucked away, a layer of dry clay collects on the cloth and increases with the length of time of immersion during 245 deg. of rotation. Suction continues in each box, for 45 deg., after it comes out of the clay. When arrived under the taking-off roll, suction has stopped and compression of air begins in the box to produce adhesion of the dry clay on the roll. Compression continues during a rotation of 45 deg., restoring complete permeablity of the cloths before again entering the wet clay. The taking-off roll carries away the crust and dry clay to an inclined plane, work being facilitated with a scraper. This filter with its adjuncts makes a very complete combination. A pump of the "Mouvex" type gives suction and compresses the mixture of air and water in a tank where water and air are separated. The air there is compressed at the higher part. The pressure can be noted on a gauge and the compressed air is conveyed to the filter by a pipe at the top of the tank. The surplus water in the tank is run off through a pipe which plunges into it, the outlet of this pipe being at a certain height to regulate pressure of air. Fig. 2 is a diagram of the plant. It will be noted that the water discharge pipe of the air reservoir (the tube at the higher part of reservoir, on the right) ends at the filter tank for the sake of convenience in demonstration workshops, and to avoid the discharged water. This water is conveyed to the mixer or run off.

The taking-off roll can be raised and supported by its counterweight in case of filtration on a very thick layer. Finally, it can be completely lifted to clean the filter and change the cloth. Fig. 3 shows the details of the scraper

and the inclined plane for discharge of the dry clay. On this side the compressed air intake is on the hub. The advantages of the Hertenbein filter may be summarised as follows :—

It is continuous ; the wear of the cloths is minimum, and their permeability constant. The drum works with 11/16 of its surface immersed, whereas most other machines only work with ¼. Finally, in the event of accident to a box, repairing is easy and rapid, and even when there is no new cloth at hand, the box can be removed, its suction and compression pipes stopped to restart the filter. It will then work with seven instead of eight boxes. Thus constructed the filter was not yet perfect. It produced a mud rather than a paste of normal consistency as it was designed to give dry products for subsequent treatment in the Hertenbein tunnel-dryer. Considering its great production, and that of the dryer, this combination would be of interest when perfectly dry products are required. This is the case with China Clay

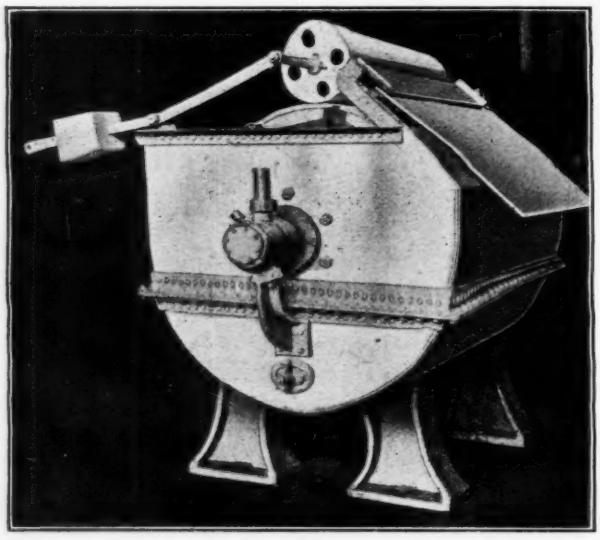


FIG. III.—FILTER ON COMPRESSION SIDE

from the pits which has to be sent away. When question of pastes for use on the spot a dry clay is needed which can go to the mixer. Consequently the filter was modified in its adjuncts. The taking-off roll, which was in the vertical axis of the hub, was moved to the side. Then the level of the liquid was decreased and speed of rotation increased. Thus the work is on a thinner layer, duration of suction outside the liquid greater, and drying intensified when the crust reaches the taking-off roll. Increase of speed compensates for a smaller immersed surface. A little demonstration apparatus has been made, the drum of which, 11·8 in. in diameter, treats 330 lb. of China Clay per hour. The yield of this type of apparatus is considerable compared with filter-presses, as shown by the following figures :—

No.	Dimensions of Plant.	Diameter. Length of Drum.		Daily Production of China Clay.
1	2·65 by 3·65 metres	1·50	1·50	20 tons
2	2·20 by 2·90 metres	1	1	10 tons
3	1·10 by 2·40 metres	0·60	0·50	5 tons

(1 metre = 3·28 ft. ; 1 metric ton = 0·98 ton)

The demonstration drum, 0·30 by 0·30 metre, considering the production, could be used in many works where filters with only 20 to 25 plates are employed.

Of course, here as in other matters, it is not enough to set up a filter and feed it with the clay to obtain a well-dried product. The density of the clay to be dried must be ascertained, also the speed of rotation of the drum and the diameter of the pores of the cloth. These factors, especially the two first, will vary with the more or less plastic properties and fineness of the material to be filtered. This is not a difficult task. The high efficiency of these filters makes them suitable for all cases where raw materials are treated with water. The small machines are also of great interest even when the products to be filtered are very different. Cleaning is much easier. There are no pipes to purge, only outer parts to wash—vat and drum.

The employment of these filters may lead to some improvements in the preparation of raw materials and pastes. As example we shall give two instances :—

1. When working by casting one cannot always mix or sift the pastes to the consistency of a barbotine for casting, which, frequently, is not fluid enough either for the sieve or mixer. With such a consistency the mixer could not blend the different parts. In this case the requisite amount of water is added for these two preliminary operations, the paste being then run through the filter-press, after which water and alkalies are added to obtain a casting consistency.

The filter-press, however, can only give cakes containing the percentage of water for normal consistency, whereas the rotary filter can produce every degree of consistency, and drying can be regulated so as to obtain a barbotine for casting simply by adding alkalies (silicate, carbonate, caustic soda). For this it suffices, suction and density of the barbotine being constant, to vary the depth of the liquid in which the drum is immersed, and also the speed of rotation.

The barbotine for casting can then be made simply with a vat and agitator.

2. A supplemental operation, much used in the chemical industry, and which wrongfully seems to be neglected in the case of China Clay, can be carried out in the new type of filter with removable taking-off roll, viz., washing the filtered product in pure water or mixed with some salt.

However, with some kinds of China Clays which cannot be made fluid enough for casting, it is advisable to get rid of the coagulating elements in the clay, which cause the trouble, by washing with alkaline water. This operation is easy and rapid and has little or no effect on the efficiency of the machine.

Silica and Alumina

By James Scott

I.—Silica and its Peculiarities

CLAYS are hydrated silicates of alumina. In other words, they are compounds of silica, alumina, and water ; and China Clay is their purest form. I propose, therefore, to deal with the two principal substances present in their composition.

Silica is used widely as a flux in the clay bodies and glazes of porcelain and other kinds of pottery. Other uses will be mentioned as I proceed with my notes. It is easily separated from China Clay ; and is obtainable in two very different conditions, namely, as a mineral jelly, and a sandy grit. But I must first deal with silicon.

Silicon is the element which has given rise to all the compounds referred to in this article. It is never found free in nature ; but is always combined as silicic acid, silica, or silicates ; which comprise by far the largest portion—probably one quarter—of the earth which is available for our examination. It is procured experimentally by fusing pure sand with magnesium. The latter substance removes the oxygen from the sand, and leaves the silicon freed as an amorphous brown powder of a very refractory character. Strong heat reconverts this powder into sand again. When the powder is dissolved or fused in molten zinc it is changed into a crystalline state, the particles being hexagonal, or else needle shaped. This form of silicon is black and lustrous, and is termed graphitoid. It cannot be reconverted into sand by means of even the most intense degrees of heat.

A third form of silicon, very hard and stonelike, is disguished as adamantine. Some authorities do not think it is distinctive enough ; but contains one or both of the other kinds.

Silicon can be prepared in the electric furnace from fused or molten solutions of many of its compounds.

The parent substance of silica and the salts known as silicates is silicic acid, which is the jelly to which reference has been made.

Silicic acid is really divided into several varieties, the main ones being called ortho-silicic acid, meta-silicic acid, and tri-

silicic acid. These are further classified into ortho-disilicic acid, and meta-disilicic acid; but it would take us too deeply into somewhat obscure technical details to consider every possible phase of the subject; and the distinctions between them all are not very well marked.

It will suit our purpose if I describe the following facts. Sand, quartz, flint, and their kindred, are oxides—or, more correctly speaking, dioxides—of silicon. That is: they are combinations of oxygen with silicon; and are often stained with iron. They are regarded as acidic oxides.

Silica, when fused, can be drawn out into strong threads (finer than those of a spider's web) which are used in several scientific directions.

It can be blown, or moulded, into tubes, and so on, which are of great industrial service, and resist air, heat, chemicals, and the hardest possible use. Indestructible thermometers, grinding mortars for chemists, and various optical apparatus, are made from silica, preferably quartz, or rock crystal.

Agate, opal, chalcedony, carnelian, mica, asbestos, and meerschaum are silicates, coloured in some cases by metallic impurities.

Ortho-silica, derived from ortho-silicic acid, is considered to be the *normal* silica.

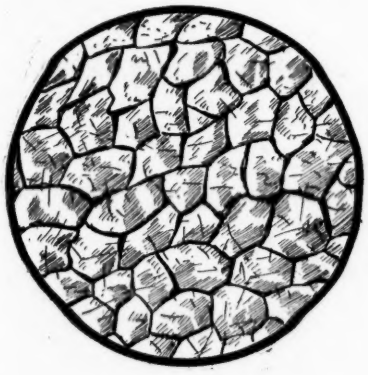


FIG. 1.—ONE TWENTY-FOURTH OF AN INCH OF THIN FILM OF DRIED SILICA, ORIGINALLY GELATINOUS AND FORMLESS, BETWEEN THIN STRIPS OF GLASS, MAGNIFIED. IT BECOMES GRITTY.

Olivine is a magnesia silicate, zircon is a zirconia silicate, and garnet is an alumina-lime silicate. All these examples belong to the series of ortho-silicates, derived from ortho-silicic acid. Wollastonite is a lime silicate; augite is a lime and magnesia silicate; and talc is a magnesia silicate. All these examples belong to the series of meta-silicates; derived from meta-silicic acid.

Felspar belongs to the tri-silicates; derived from tri-silicic acid.

Silica may be amorphous or crystalline. Jasper is typical of the first named; quartz and tridymite of the second. The melting point of silica is very high; but it can be volatilized by the temperature of the electric arc.

A ready method by which gelatinous silicic acid can be obtained is to pour hydrochloric acid into a strong aqueous solution of waterglass, which is sometimes called soluble glass. This is a meta-silicate; and is the mineral jelly used for preserving eggs. It is made by fusing together, in a crucible, one part of pure sand with four parts of soda carbonate, or potash carbonate; and then boiling the product for a long time in water. It is, in consequence, either a soda or potash silicate. When exposed to the air the former attracts carbon dioxide, and is partly changed into opaque white crystals of soda carbonate.

Another process for preparing waterglass is to make flints red hot, and then plunge them suddenly into cold water, whereupon they are split into powder. The latter, in the proportion of two drachms, is then boiled for several hours in a strong solution—about four drachms—of caustic potash or soda, and two ounces of water, which is renewed as fast as it evaporates. It is then allowed to stand in a corked bottle to settle.

This silicate, or waterglass, is used to a very large extent to harden soft building stones; and for the manufacture of similar stones by mixing it with sand.

The effect of adding hydrochloric acid to an aqueous solution of waterglass is to isolate a transparent white jelly, H_2SiO_3; which, when filtered off, washed with water, and dried by heat, becomes white opaque gritty sand, $H_2Si_2O_5$.

Some investigators regard this orthosilicic acid as H_4SiO_4 when it is in aqueous solution; and the meta-silicic acid, or gritty kind, as H_2SiO_3; but we need not quarrel about the matter. There are numerous *gradations* of liquid jelly to hard dry grit; and no doubt several formulas could be written.

If the soluble glass is very much diluted with water no jelly will appear at first when the solution is acidulated; but

FIG. 2. — ONE TWENTY-FOURTH INCH OF A SMALL BLOCK OF A TRANSPARENT, GELATINOUS SILICA, AFTER BEING PROBED WITH A NEEDLE, WHICH CAUSED IT TO CHANGE FROM AN AMORPHOUS TO A SEMI-CRYSTALLINE STATE, MAGNIFIED.

after some hours the mass will suddenly change into a gelatinous state.

The sandy grit can be more readily obtained by using strong hydrochloric acid on the waterglass jelly when it contains so little water that it can be drawn out like very thick glue.

Ammonia carbonate added to a solution of the waterglass will also precipitate the jelly.

When absolutely freed from any water whatever the silica, or dioxide, is called anhydrous.

Soluble silica—very thin silicic acid—is found in most of our springs, especially in the vicinity of China Clay deposits, whence it has been abstracted by rains and rivers, assisted by dilute acids. Plants, more particularly grasses and cereals, are very rich in minute particles of silica, which strengthen their tissues and enable them to retain their shapes when they are dried; and is melted to a glass when they are burnt. Many minute shells consist of silica. It is thus one of the most important compounds to be obtained.

In my experiments I precipitated some of the gelatinous silicic acid in the manner described, with hydrochloric acid; and squeezed it between two strips of glass. Although it was apparently shapeless it was then evident that it consisted of thin flakes, with a semi-crystalline nature, overlapping one another. It eventually dried into a film composed of particles as in No. 1.

FIG. 3.—ONE TWENTY-FOURTH INCH OF A THIN LAYER OF GRITTY SILICA, FROM DRIED GELATINOUS SILICA PUSHED TO AND FRO BETWEEN TWO GLASSES. THE ANGULAR FLAKES ARE INSOLUBLE, THE CRYSTALS SOLUBLE, AND CAPABLE WHEN DISSOLVED OF RELEASING JELLY OR GRIT. SODA CHLORIDE IS EVOLVED, AND MAY INFLUENCE THE FORMATION. MAGNIFIED.

A very curious feature was demonstrated by probing a small mass of the jelly with a fine needle point, meantime observing it through the microscope. The jelly was, to begin with, almost wholly transparent and amorphous; only a few creases indicating a tendency to shrink into modules. As the needle

[*Continued on page* 14]

[*Continued from page* 11]

point travelled hither and thither the jelly split up, rejoined, and again divided, until semi-crystalline particles, still united together, appeared in relief against the surroundings, as in No. 2. The longer the operation lasted the smaller became the crystalline grains. No doubt soda chloride, evolved in the reactions, influenced this shaping.

I next dried a small lump of the jelly and found that it contracted into solid particles having irregular edges, but with internal arrangements of tiny, heaped together crystals.

By pouring strong hydrochloric acid on to a quantity of very thick waterglass the latter was, as already stated, modified into grit, which seemed to be shapeless. But when the result was moved about between two close-pressed glass slides I could see that it was largely composed of squares, cubes, oblongs, and kindred objects, the crystals being mixed with angular flakes, as shown in No. 3.

The dense overlying of the particles masked the forms, so far as general observation was concerned. There, again, the salt may have affected the substance.

The behaviour outlined proves that silica is a unique mineral. It can be jellified or gritted at will; and can be amorphous or crystalline alternately, in minute dimensions. The crystalline forms were mostly soluble, but released some grit when watered. Seeing how strange it is that quartz—one of its varieties—can be found wholly devoid of external shape, yet internally crystalline in structure, according to optical inspection without showing any junctions, or actual presence of such crystals, I think that my experiments should possess some interest.

Absolute alcohol can be made to combine with silicic acid, or jelly, by indirect means, to compose a pleasant smelling, volatile, *liquid ether*, which is split up, when watered, into silica (sand) and alcohol, which is otherwise known as spirits of wine!

Paper-Making in Canada

Water Power Advantages

In view of the prominent place which the pulp and paper industry has taken in Canada and the important part played in its development by water power, the Dominion Water Power Branch recently undertook a special study of the subject, and has collected a mass of information on the installations and requirements of pulp and paper mills operated by water power or by purchased hydro-electric energy.

It is pointed out that in the production of pulp and paper the question of motive power is almost as important as that of raw material. To make a ton of paper a day takes practically 100 h.p. The average figures for a large Canadian mill show that mechanical pulp requires 73 h.p. per ton of daily output, 67 h.p. being for grinding alone; sulphite pulp requires 8·7 h.p., and in some large mills as much as 20 or 30 h.p.; and the production of newsprint from pulp 12 h.p. The continuous operation of the mills, usually 24 hours per day, permits of very advantageous use of the necessary power, and with direct water power or hydro-electric energy further allows a cheap unit cost for the amount consumed. For instance, one sulphite mill with an installation of 1,500 h.p. purchases hydro-electric power on the basis of $1 per h.p. per month *plus* a consumption charge on a sliding scale, and it has been found that advantage can be taken of the minimum rate of 0·1 cent per kW. hour for about 75 per cent. of the total consumption.

The water power installations for the operation of pulp and paper mills aggregate 476,503 h.p., while the additional hydro-electric energy purchased for the industry amounts to 160,577 h.p., giving a total of 637,080 h.p. in 113 mills. The use of steam is very limited—according to the census returns of 1920 the total steam power installations in pulp and paper mills amounted to only 62,400 h.p.—and is usually prompted by special conditions such as operation in close connection with the manufacture of timber, when the refuse can be employed as fuel under the boilers. While a large amount of water power is still used to drive the mill equipment directly from the turbines, a considerable portion is utilised by first converting it to hydro-electric energy for the more convenient electric motor drive. Of the total water power installations for the various mills, 178,911 h.p. is so converted, 297,592 h.p. being employed for direct drive, but if the energy purchased from outside sources is included the total figure for hydro-electric energy becomes 339,488 h.p. The two modes of operation are fairly evenly divided in British Columbia and Quebec, the electric drive predominates in Ontario and New Brunswick, and in Nova Scotia direct water power drive is used almost entirely.

Quebec's 54 Mills

In Quebec there are 54 mills requiring a total of 312,867 h.p., of which 88,455 is purchased hydro-electric power. The total daily producing capacity of these mills is some 3,000 tons of mechanical pulp, 1,500 tons of chemical pulp, 1,300 tons of news print, and 700 tons of other kinds of paper. The three largest mills, each requiring 25,000 h.p. or more, are at Grand'mere, where all the hydro-electric energy is purchased; Kenogami, where power is obtained from two hydro-electric plants in addition to that produced at the mill; and Shawinigan, where a portion of the power is purchased.

The 41 mills in Ontario have 242,764 h.p., of which 88,455 is purchased hydro-electric energy. Their daily producing capacity is some 2,000 tons of mechanical pulp, 1,100 tons of chemical pulp, 1,800 tons of news print, and 600 tons of other sorts of paper. The Iroquois Falls Mill requires 52,000 h.p., including the energy transmitted from Twin Falls, and another large mill at Ottawa has an installation of 28,789 h.p.

British Columbia possesses five mills worked by water power, capable of a daily output of 390 tons of mechanical pulp, 345 tons of chemical pulp, 445 tons of news print, and 30 tons of other paper. Of the total installation of 48,800 h.p., the two large mills at Powell River and Ocean Falls, with 24,000 and 20,550 h.p. respectively, account for 44,550 h.p.

Three mills in New Brunswick, with a total installation of 14,668 h.p., can produce 80 tons of mechanical and 250 tons of chemical pulp daily, and in Nova Scotia there are 10 mills with an aggregate installation of 17,999 h.p., and a daily productive capacity of some 230 tons of mechanical pulp.

Great Future Growth

The available supplies of pulp wood and water power, which are the chief factors on which the future expansion of the industry depends, are shown in the following table:—

Province.	Estimated Pulp Wood Resources (million cords).	Available Water Power at ordinary minimum flow (h.p.).
Quebec	300	6,915,244
British Columbia	285	1,931,142
Ontario	200	4,950,300
Prairie Provinces	185	4,259,253
New Brunswick	33	50,406
Nova Scotia	30	20,751
	1,033	18,127,096

According to a recent estimate the present wood pulp demands on the forests of Canada consume some 20,000 acres a year, and, as with other commodities, this consumption will probably proceed at a rapidly increasing rate. The reforestation methods now being extensively introduced will later on help to remedy this depletion, but a period of from 50 to 100 years is required for suitable growth, and until full results are realised it will doubtless be necessary to extend wood pulp operations farther and farther north, so that the northern water powers will be called on to take an important part in the future development of the industry.

Fuller's Earth Find

1,000,000 Ton Deposit to be Worked in Cornwall

Following the discovery by Mr. Stephen Clark of a rich deposit of Fuller's Earth on his estate at Treamble, it is expected that a considerable new Cornish industry will be established. One estimate puts the amount of the deposit at 1,000,000 tons, and it has been proved in places to go to a depth of fifty feet. Excavating machinery is already being installed.

Analytical chemists declare samples to be equal in quality to the best Fuller's Earth available. The new deposit requires only a simple process of washing, settling, and drying before being ready for the market.—*Morning Post.*

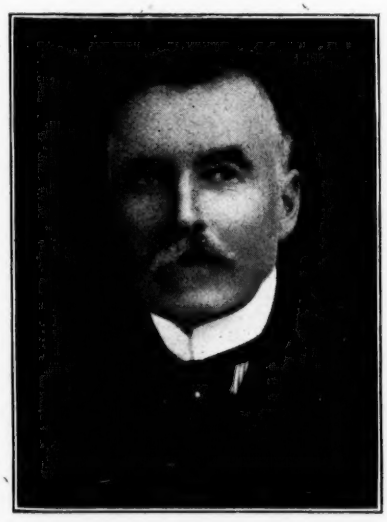
China Clay Notes and News

Fatality in a Disused China Clay Pit

Two brothers, engaged in the China Clay industry, one at the Bloomdale China Clay Works and the other at the Goonvean China Clay Works, were drowned in the disused China Clay pit at East Carloggas, belonging to the English China Clays, Ltd. What happened was described at the inquiry, held before the County Coroner, by Captain Walter Light, who represented the English China Clays, Ltd. He said it was probable that the elder lad, Reginald Osborne, entered the water and as soon as he got out of his depth was observed to be in difficulties. The younger brother, Frank, realising the danger and forgetting his own safety, went to Reginald's rescue. It was a chivalrous act for a non-swimmer, but there was no chance whatever on entering such a pool. Captain Light explained that the pit was not fenced as it was within the boundary of the English China Clays, Ltd., and all who went there were trespassing. The verdict was that Reginald was accidentally drowned whilst bathing and that Frank was drowned trying to save his brother.

Visitors to China Clay Works

If a record of all the distinguished visitors to the China Clay industry could be collated it would make an interesting collection. Last month the visitors included Mr. J. Lovering, the senior member of the firm of John Lovering and Co., and two or three French representatives. Mr. E. J. Hancock, managing director of the West Carclaze China Clay Co., Ltd., and other mines, informs us that Mr. Bownocker, the State Geologist of Columbus, Ohio, U.S.A., accompanied by Mrs. Bownocker, has just visited Devon and Cornwall, and been greatly interested in the various China Clay deposits. While in Cornwall, Mr. and Mrs. Bownocker were the guests of Mr. and Mrs. E. J. Hancock at St. Austell. Before leaving England Mr. Bownocker visited several collieries through letters of introduction by Mr. Hancock.



MR. FRANK PARKYN.

Mr. Frank Parkyn

Mr. Frank Parkyn, principal of the firm of Parkyn and Peters, China Clay producers, of St. Austell, has been elected president of the St. Austell Cottage Gardening Society, one of the oldest societies in the clayopolis. That Mr. Parkyn takes a keen interest in such institutions is strikingly illustrated by his long association as secretary and organiser of Lerryn Annual Regatta and Sports. Lerryn is one of those beautiful inlets on the River Fowey, and in this attractive aquatic fixture Mr. Parkyn secures the support of most of the principal China Clay producers in the district. This year's gala day was held on the latter part of last month, when the river presented a gay and animated scene.

Modern Millgearing

We have received from David Bridge and Co., Castleton, Manchester, a copy of their interesting and comprehensive treatise on modern millgearing. Its treatment of the subject goes much deeper than that of the usual trade catalogue, and should be in the hand of every works manager. The work contains 132 pages and includes many illustrations, diagrams and working formulæ. The text is clearly printed on art paper and prices for all classes of millgearing are quoted. The 52-page appendix covers the whole field of power transmission and is of especial value to engineers, draughtsmen, etc., who want a pocket size authority on this subject. Among points dealt with are: shafting, keys, and keyways, couplings, rope driving, belt driving, gearing, chain driving, speed change gears, etc. A copy of this work is sent free on request.

Pay Up!

The Western Morning News says: "It was stated at Torrington Rural Council, when it was decided to send a cheque to Torrington-Halwill Railway directors on account of the debentures taken up by the Council, that the private investors who had taken shares were not paying up as they should. If this is the case it is surely a foolish as well as an unworthy policy. The Government gave a grant and the local bodies took up debentures, on the understanding that private subscriptions would be forthcoming to make up the balance required. Any failure on the part of the shareholders can only endanger the future of the line, and possibly delay the time when it will be got into working order.

China Clay Bandsmen

The seventh annual West of England's Bandsmen's Festival was held on Saturday, August 25, at Bugle, near St. Austell, and provided a function of exceptional interest throughout the China Clay district. Among the competing bands there were four practically composed of China Clay workers—St. Dennis, Foxhole-Greensplatt, and Indian Queens, and there are several in the St. Austell Town Band. St. Dennis easily maintained their reputation in securing the premier honours of the first section, and Foxhole Band, although they reduced their prestige slightly, were presented with a cheque for £20 by Sir Edward Nichol, late member for the division, toward the cost of their uniforms, in recognition of the fact that previous to the last contest they had won his challenge cup outright by heading the winners three years in succession. St. Dennis Band has been the leading county band for several years, and the secretary of the Bugle Band Festival has received an intimation from Mr. Walter Peacock, Secretary to the Duchy of Cornwall, that the Prince of Wales will be pleased to give silver medals to members of the St. Dennis Band in commemoration of their winning the Royal Trophy and West of England amateur band championship three successive years. The president of the St. Dennis Silver Prize Band is the Hon. H. D. McLaren, C.B.E.

Mr. C. H. Knight

Mr. C. H. Knight, President of the Papermakers' Importing Co., Easton, Pa., has just been over on a brief visit to England, and has spent a few days in Cornwall. We happened to meet Mr. Knight and the firm's representative at St. Austell, Mr. S. A. Liddicoat, enjoying a river trip on the Fowey River. With reference to the American trade, Mr. Knight observed that there had been a falling off in exports during August, which is generally the rule, but things were moving again now and the remainder of the year would be more satisfactory. The loading of several large steamers at Fowey during the present month for American consumers bears out Mr. Knight's observations.

New Jetty at Fowey

The new jetty at Fowey is rapidly assuming completion, and as a mechanical transporter there is nothing comparable to it in the West of England, and the enormous cost to the Great Western Railway authorities of something like £300,000 shows the confidence they have in the China Clay industry.

Industrial and Trade Reports

[From Our Own Correspondents and Other Sources]

United States of America

Probably the feature of the New York markets has been the increase in inquiry for paper of various kinds from numerous consuming quarters. Manufacturers, mill agents and jobbers report a quickening of buying interests, and although it is stated that actual demand has not yet shown any appreciable expansion, the mere fact that consumers are commencing to look ahead and figure on their probable requirements has created an improved market tone and strengthened the belief among sellers of paper that big business is not far off. Some big inquiries for book papers for forward delivery have been reported emanating from publishing sources, and are regarded as a forerunner of large business for this class of paper. Book mills are fairly well fixed as it is with orders and are operating at a good rate of capacity and are firmly maintaining quotations on their product, following the easing off of prices a short while ago. Machine finished book paper is quoted at around 6.50 cents a pound f.o.b. New York, though some lines are available at a quarter to a half cent under this price, while coated book paper are steady at between 8 and 11 cents per pound, depending on quality.

China Clay Deposits in Malay

The correspondent of the *Financial Times* writes :

Kuala Lumpur.

Although the name of Malaya has become almost synonymous with rubber, and to a lesser degree, perhaps, with tin, several other industries have been established recently which promise to produce considerable profit primarily for those who are interested in them, and, incidentally, the Government. We have a very large colliery exploited with the most modern machinery, and giving a handsome return to those who have invested money in it. We have a most up-to-date match factory which is still in the development stage. We have lately established a pottery industry which bids fair to eclipse the success of all other industries.

A short time ago, Dr. William R. Jones, D.S.C. (London), D.I.C., F.G.S., M.I.M.M., F.R.G.S., discovered extensive China Clay deposits on land adjoining the Gopeng Consolidated Company's well-known tin mine in the village of Gopeng, not far from the famous tin mining centre of Ipoh. Exhaustive investigations were immediately carried out to ascertain the exact amount of raw material available before a pottery was started. These were found to be enormous and the manufacture of pottery has now passed the experimental stage.

Unique Advantages

Large deposits of China Clay, china stone, fire clay, whiting, lime and raw glass have been found. In view of the fact that one of the nearest consuming countries for Cornish China Clay is India, which imports 25,000 tons of it annually, the possibilities before the Malayan industry can be easily realised. They were in fact realised by the late Lord Northcliffe when he was on a visit to this country last year. China Clay from the deposits at Gopeng, of which large quantities have already been exported to India, Australia, Java, China and Japan, has been most favourably reported upon.

The extent of the market for the various articles which can be manufactured locally can be seen from the following statement of imports into the country during the past four years :—

	1919. Dollars.	1920. Dollars.	1921. Dollars.	1922. Dollars.
Crockery and Porcelain ..	2,085,887	1,999,689	1,240,275	1,304,397
Tiles and bricks	532,912	709,360	510,809	409,559
Earthenware	669,195	732,442	524,400	433,138
Glass Bottles	336,326	557,134	314,527	210,983
Glass and Glassware ..	749,904	1,645,379	779,495	523,473
	4,374,234	5,643,984	3,369,506	2,881,550

The above figures represent imports into the Straits Settlements and the Federated Malay States only. In addition, the markets of Java, Sumatra, Siam, India and other adjoining countries are nearer to this country than to the countries from which at the present time these large supplies are obtained. The opportunity for the expansion and profitable development of a well-organised industry can be easily understood when it is known that Java and Sumatra has a population of over 28,000,000, Siam 6,000,000, India 320,000,000, Ceylon 4,000,000.

The following statement shows the principal countries from which the imports into Malaya are at present drawn :—

Crockery and Porcelain : China (including Hong Kong), 38 per cent. ; Japan, 33 per cent. ; and United Kingdom and Netherlands, 27 per cent.

Tiles and Bricks : United Kingdom, 56 per cent. ; and the Continent, 24 per cent.

Earthenware : United Kingdom, 36 per cent ; Netherlands, 5 per cent. ; and China (including Hong Kong), 52 per cent.

Glass Bottles : United Kingdom, 33 per cent. ; Japan, 17 per cent. ; United States of America, 10 per cent. ; Canada, 9 per cent. ; and Netherlands, 5½ per cent.

Glass, Glassware : Japan, 44 per cent. ; Continent, 30 per cent. ; United Kingdom, 15 per cent. ; and Hong Kong, 5½ per cent.

It is, therefore, reasonable to assume that freight charges and brokerages on supplies drawn from such distant countries must be very heavy and put the local manufacturer at an enormous advantage over foreign competitors. The principal factor, however, which will enable the local manufacturer to put his products on the markets at rates which should easily compete with all imported articles is that all the raw materials required in bulk for the manufacture of his products can be obtained either on or within a very few miles of the works. This, according to Dr. Jones, who ought to know something about it, is unique in the pottery industry. The potteries in England and elsewhere, he says, obtain some of their most important raw materials from long distances, and in some cases even from other countries.

China Clay in Ireland

Reporting on "Irish Coal and Mineral Resources" in the *Manchester Guardian Commercial*, Mr. Henry J. Seymour, Professor of Geology, Dublin University, says that China Clay (kaolin) deposits have recently been discovered in a comparatively small area examined by the writer last year. The indications are that economic deposits of this valuable substance may be expected to occur on the western side of the Leinster granite range further south than the district which he has prospected. The mode of occurrence is somewhat similar to that in Cornwall.

Commercial Intelligence

Mortgages and Charges

[*NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

ALSEVEOR CHINA CLAY CO., LTD., St. Austell.—Registered August 24, debenture, to bank ; charged on properties at St. Austell and Trethurgey, also general charge. *——. June 14, 1923.

ANCHOR CHINA CLAY SYNDICATE, LTD., London, E.C.—Registered August 7, Trust Deed dated July 18, 1923, securing £3,000 debenture stock ; charged on present and future stocks of China Clay, and all moneys and securities for money from time to time belonging to or due to the company. *£2,080. November 17, 1922.

POINTER (HORACE T.), LTD., London, S.E., paper manufacturers.—Registered August 1, £2,000 debentures ; general charge ; also registered August 1, £2,000 Land Registry charge collateral to above, to G. H. Wilkinson, 66, Upper Thames Street, E.C., paper manufacturer ; charged on 29, Pomeroy Street, New Cross (subject to £2,000 mortgage).

Shipping and Export News of the Month

We give below the latest particulars relating to arrivals and sailings of ships engaged in the China Clay Trade, at the principal British clay ports. Registered exports of China Clay with countries of destination, and other shipping and export matters are dealt with.

Shipping—Fowey, August, 1923

Arrived.		Name.	Sailed.	For.
August 1.	S.S.	*Spaarnestroom*	August 4.	Amsterdam
August 1.	S.S.	*Silva*	August 4.	Leith
August 2.	S.S.	*Torrhead*	August 15.	Portland, Me.
August 2.	S.V.	*Leif*	August 15.	Helsinfors
August 4.	S.S.	*Pansy*	August 7.	Grimsby
August 4.	S.S.	*James Tennant*	August 8.	Sunderland
August 4.	M.V.	*Katie*	August 10.	Par
August 4.	S.S.	*D'Seidler*	August 8.	Bo'ness
August 4.	S.S.	*Falmouth Castle*	August 9.	Weston Point
August 5.	S.V.	*Shortest Day*	August 8.	Gweek
August 8.	S.S.	*Farfield*	August 10.	Antwerp
August 8.	S.V.	*Helena Anna*	August 22.	Newcastle
August 8.	S.S.	*Moss Rose*	August 9.	Fleetwood
August 9.	S.S.	*Briar Rose*	August 10.	Runcorn
August 9.	S.S.	*Condor*	August 16.	Rouen
August 9.	S.S.	*Chrysalis*	August 11.	Bo'ness
August 9.	S.V.	*Alert*	August 17.	Weston Point
August 10.	S.S.	*Baltimore Maru*	August 21.	Portland, Me.
August 10.	S.S.	*Liana*	August 16.	Brussels
August 10.	M.V.	*Alpha*	August 18.	Hamburg
August 10.	S.S.	*Shellie*	August 16.	Fleetwood
August 10.	S.V.	*Eclipse*	August 14.	Plymouth
August 11.	S.S.	*Jacques Ranet*	August 14.	Gravelines
August 11.	S.S.	*Primrose*	August 15.	Preston
August 12.	S.S.	*Elvington*	August 17.	Brussels
August 12.	S.S.	*Multistone*	August 16.	Gravesend
August 12.	S.S.	*Millocrat*	August 14.	Birkenhead
August 12.	M.V.	*Airston*	August 12.	Par
August 12.	S.S.	*Cortes*	August 15.	Barcelona
August 14.	S.S.	*Halton*	August 21.	Ridham
August 14.	S.V.	*Agiena II.*	August 21.	Copenhagen
August 14.	M.V.	*Norham*	August 18.	Rouen
August 15.	S.S.	*Edern*	August 18.	Aberdeen
August 16.	M.V.	*Airston*	August 18.	Chiswick
August 16.	S.V.	*Adelaide*	August 24.	Irvine
August 17.	S.S.	*Cargan*	August 21.	Runcorn
August 17.	S.V.	*Black Cat*	August 31.	Runcorn
August 17.	S.V.	*Alzina*	August 20.	Plymouth
August 18.	S.S.	*Falmouth Castle*	August 20.	Runcorn
August 19.	M.V.	*Donald and Doris*	August 22.	Gravesend
August 20.	S.S.	*T. W. Stewart*	August 22.	Treport
August 20.	S.S.	*Katherine*	August 22.	Plymouth
August 21.	S.S.	*Rosabell*	August 23.	Weston Point
August 22.	S.S.	*Seaforth*	August 24.	Runcorn
August 22.	S.S.	*Glenrose*	August 27.	Gravesend
August 23.	S.S.	*Bilton*	August 28.	Antwerp
August 23.	S.V.	*Lord Lansdowne*	September 1.	Boston, Lincs.
August 23.	S.S.	*Nigretia*	August 26.	Seville
August 24.	S.S.	*Sutton*	August 28.	Brussels
August 24.	S.S.	*Christiania*	August 27.	Birkenhead
August 24.	S.V.	*Zeus*	August 30.	Harbourg
August 24.	S.S.	*Nanset*	September 3.	Grimsby
August 25.	S.S.	*Moss Rose*	August 27.	Charlestown
August 25.	S.S.	*Eskbridge*	August 31.	Boston, U.S.A.
August 25.	S.V.	*Amanda*	September 1.	Runcorn
August 25.	M.V.	*Hetty*	*	
August 25.	S.V.	*Two Sisters*	August 28.	Par
August 25.	S.V.	*Cetus*	August 26.	Charlestown
August 25.	S.S.	*Leaside*	August 30.	Bo'ness
August 25.	S.V.	*Venta*	September 1.	Snodland
August 26.	S.S.	*Pansy*	August 28.	Preston
August 27.	M.V.	*May Blossom*	August 31.	Looe
August 27.	S.S.	*Artificer*	August 30.	Antwerp
August 27.	S.V.	*Emily Warbrick*	September 6.	Grimsby
August 27.	S.T.	*Perran*	August 27.	Falmouth
August 28.	S.V.	*Isabella*	September 4.	Par
August 28.	S.S.	*Shelley*	August 31.	Preston
August 28	S.S.	*Recoverer*	August 30.	Penzance
August 30.	S.S.	*Torfrey*	September 2.	Passages
August 30.	S.S.	*Martinez Rivas*	September 5.	Bilbao
August 30.	S.S.	*Falmouth Castle*	September 1.	Runcorn
August 30.	S.S.	*Linmere*	September 3.	Genoa
August 30.	M.V.	*Theodora*	September 1.	Mevagissey
August 30.	S.S.	*Katherine*	September 3.	Pentewan
August 30.	S.S.	*Lindenhall*	September 8.	Boston & New York

* Signifies in port.

Par Harbour Shipping—August, 1923

Arrivals

Date.	Vessel's Name.	From.
Aug. 1.	S.S. *Catherine*	Falmouth
Aug. 5.	S.V. *Fanny Crossfield*	Falmouth
Aug. 5.	S.S. *Tanny*	Avonmouth
Aug. 6.	S.V. *Lady Roseberry*	Rochester
Aug. 6.	S.V. *Amy*	Falmouth
Aug. 7.	S.V. *J.N.R.*	Plymouth
Aug. 8.	S.V. *Triumph*	Charlestown
Aug. 10.	S.S. *Evelyn Manor*	Plymouth
Aug. 10.	S.V. *Eclipse*	Plymouth
Aug. 10.	S.V. *Regina*	Plymouth
Aug. 11.	M.V. *Besse Ellen*	Bristol
Aug. 11.	M.V. *Katie*	Rochester
Aug. 13.	M.V. *Earl Cairns*	London
Aug. 13.	S.S. *Miriam Thomas*	Charlestown
Aug. 13.	M.S. *Airston*	Antwerp
Aug. 14.	S.S. *Magrix*	Hull
Aug. 15.	S.V. *Snowflake*	Runcorn
Aug. 16.	S.S. *Tanny*	Avonmouth
Aug. 22.	S.V. *Mimi*	Pentewan
Aug. 23.	S.V. *Success*	Falmouth
Aug. 24.	S.V. *Lizzie Trenberth*	Falmouth
Aug. 24.	S.V. *Tanagona*	Falmouth
Aug. 25.	S.V. *Hector Cundy*	Salcombe
Aug. 25.	M.V. *Haldon*	Falmouth
Aug. 26.	S.S. *Tanny*	Bristol
Aug. 27.	S.V. *Englishman*	Falmouth
Aug. 28.	S.V. *Two Sisters*	London
Aug. 31.	S.V. *Wilhelmina*	Salcombe

Sailings

Date.	Name.	Destination.
Aug. 1.	M.V. *Isabel*	Poole
Aug. 1.	S.S. *Catherine*	Plymouth
Aug. 8.	S.V. *Lady Roseberry*	Charlestown
Aug. 9.	S.S. *Tanny*	Penarth
Aug. 9.	S.V. *J.N.R.*	Pentewan
Aug. 10.	S.V. *Triumph*	Plymouth
Aug. 10.	S.V. *Eclipse*	Fowey
Aug. 13.	S.V. *Amy*	Grimsby
Aug. 14.	S.V. *Fanny Crossfield*	Kirkcaldy
Aug. 14.	S.S. *Evelyn Manor*	Rouen
Aug. 14.	M.V. *Bessie Ellen*	Pentewan
Aug. 16.	S.S. *Miriam Thomas*	Charlestown
Aug. 16.	M.S. *Airston*	Fowey
Aug. 17.	S.S. *Magrix*	Gravesend
Aug. 17.	S.S. *Tanny*	Newlyn
Aug. 18.	M.V. *Katie*	Rochester
Aug. 18.	M.V. *Earl Cairns*	Western Point
Aug. 25.	S.V. *Snowflake*	Runcorn
Aug. 28.	S.V. *David Morris*	Swansea
Aug. 28.	S.V. *Mimi*	Kotka
Aug. 28.	S.V. *Tanagona*	Preston
Aug. 30.	S.V. *Hector Cundy*	Irvine
Aug. 31.	M.V. *Haldon*	Penarth
Aug. 31.	S.S. *Tanny*	Bristol

Charlestown Shipping—August, 1923

Arrivals

Date.	Name.	From.
Aug. 2.	*Rosabelle*	Cowes
Aug. 8.	*Lady Roseberry*	Par
Aug. 11.	*Miriam Thomas*	Barry
Aug. 12.	*Mary Barrow*	Clemens
Aug. 14.	*Lady Daphne*	Truro
Aug. 14.	*Overton*	Plymouth
Aug. 16.	*Sapphire*	Southampton
Aug. 16.	*Hero*	Falmouth
Aug. 16.	*Miriam Thomas*	Par
Aug. 22.	*Guiding Star*	Falmouth
Aug. 26.	*Hosianna*	Falmouth
Aug. 26.	*Adam Smith*	Brest
Aug. 26.	*Cetus*	Plymouth
Aug. 27.	*Moss Rose*	Fowey

Charlestown Sailings

Date.	Name.	Destination.
Aug. 3.	*Rosabelle*	Fleetwood
Aug. 14.	*Lady Roseberry*	Rochester
Aug. 15.	*Overton*	London
Aug. 16.	*Louistic*	Nantes
Aug. 16.	*Mary Barrow*	Rochester
Aug. 17.	*Sapphire*	Preston
Aug. 18.	*Miriam Thomas*	Fleetwood
Aug. 20.	*Lady Daphne*	Rochester
Aug. 27.	*Hero*	Runcorn
Aug. 27.	*Guiding Star*	Runcorn
Aug. 27.	*Adam Smith*	London
Aug. 28.	*Moss Rose*	Barrow
Aug. 31.	*Hosianna*	Runcorn
Aug. 31.	*Cetus*	London

Par Harbour Tide Table, September, 1923

(British Summer Time throughout.)

Day of Week.	Day of Month.	Morning.	Afternoon.	Height.
Saturday	1	9.35	9.51	11.5
SUNDAY	2	10.8	10.27	10.9
Monday	3	10.48	11.11	10.0
Tuesday	4	11.37	—	9.6
Wednesday	5	0.8	0.45	9.3
Thursday	6	1.26	2.8	9.7
Friday	7	2.49	3.27	10.4
Saturday	8	4.0	4.29	11.4
SUNDAY	9	4.54	5.18	12.4
Monday	10	5.41	6.3	13.2
Tuesday	11	6.25	6.46	13.6
Wednesday	12	7.8	7.29	14.1
Thursday	13	7.49	8.9	14.2
Friday	14	8.30	8.51	13.11
Saturday	15	9.12	9.33	13.3
SUNDAY	16	9.54	10.16	12.4
Monday	17	10.41	11.9	11.4
Tuesday	18	11.41	—	10.5
Wednesday	19	0.18	0.59	10.0
Thursday	20	1.43	2.28	10.3
Friday	21	3.9	3.46	11.0
Saturday	22	4.18	4.46	11.9
SUNDAY	23	5.10	5.32	12.4
Monday	24	5.53	6.13	12.9
Tuesday	25	6.31	6.48	12.11
Wednesday	26	7.5	7.21	13.0
Thursday	27	7.36	7.51	12.11
Friday	28	8.5	8.19	12.8
Saturday	29	8.34	8.49	12.2
SUNDAY	30	9.3	9.18	11.7

August China Clay Deliveries

The figures of total deliveries for August disclose the fact that the lull in the China Clay trade which followed the heavy June total still continues. The chief falling off has been in shipments from Fowey showing the decrease in the export demands is responsible for the present position. The shipments from Fowey were only 710 tons above July, but the deliveries through other ports and by rail were well maintained. The grand total was 60,775 tons, against 62,103 in July and 71,347 in June. The total for this year to date has been 555,135 tons against 409,793 tons for the corresponding eight months last year, so that the record this year is still well ahead of last year. Following are the details of the deliveries this year :—

Port.	Tonnage.
Fowey	49,390
Par	3,558
Charlestown	3,546
Plymouth	627
	57,121
By rail throughout	3,654
Grand total	60,775 tons

China Clay Exports

Return showing the exports of China Clay (including Cornish or China Stone) the produce or manufacture of the United Kingdom from the United Kingdom to the several countries of destination registered during the month ended July 31, 1923.

COUNTRY OF DESTINATION.	QUANTITY. Tons.	VALUE. £
Finland	760	1,432
Sweden	602	1,889
Norway	3	11
Germany	1,110	3,092
Netherlands	878	2,141
Belgium	3,131	6,132
France	2,324	5,767
Spain	67	267
Italy	1,201	3,602
China	10	80
Japan	57	400
United States America—Atlantic	15,446	35,319
United States America—Pacific	184	579
Mexico	35	98
Brazil	2	14
Argentine Republic	57	233
Nigeria	—	1
Transvaal	20	50
Bombay *via* Other Ports	338	1,350
Madras	40	160
Bengal	61	244
New South Wales	6	32
Queensland	—	2
Canada—Atlantic	39	99
Irish Free State	—	5
Total	26,371	62,999

This was issued too late for publication last month. August figures will be published next month.

Antwerp Arrivals

We give below particulars of arrivals of China and Ball Clay in the port of Antwerp during the month of August :—

From				
Fowey	S.S.	*Coniston*	575	tons
Cardiff	S.S.	*Startforth*	200	,,
Fowey	S.S.	*Seaforth* . . 40 barrels and	286	,,
Plymouth	S.S.	*Naiad*	240	,,
London	SL.	*Annie Jones*	185	,,
Poole	BRG.	*Lord Haig*	160	,,
Poole	SL.	*Gothie*	250	,,
Fremington	S.S.	*Orenie* . . about	570	,,
Poole	BRG.	*Matilda Upton* . . ,,	170	,,
Poole	BRG.	*Lord Roseberry* . . ,,	150	,,
Poole	BRG.	*Knowles*	140	,,
Teignmouth	S.V.	*Elsa*	200	,,
Bideford	S.V.	*Mary Watkinson*	225	,,
Fowey	S.S.	*Bilton* . . . . . 50 bags and	858	,,

New Port Facilities for China Clay

The Falmouth St. Just Ocean Wharves scheme has powerful advocates among shipping people and engineers. The last named are emphatic that the St. Just scheme would enable deep-water berths to be provided at moderate cost, to which the largest vessels afloat could gain access under all tidal conditions.

With this project is linked the construction of a railway to connect St. Just with both the Great Western and South Western Systems, and to serve the needs of the China Clay industry by providing a port of shipment alternative to Fowey, which is at present the focus of the export trade in China Clay. It is fairly common knowledge that nothing but the financial stringency and the difficulty of raising capital for new schemes of this character has prevented a definite move being made with both the Cattewater (Plymouth) and St. Just works. The latest news suggests that these difficulties are being smoothed out, and that the co-operation of shipping interests is likely to be obtained.

The China Clay Trade Review

The Official Organ of the China Clay Industry and the only Journal specially devoted to its interests. Published in the third issue of "The Chemical Age" each month.

All Editorial communications should be addressed to the Editor, "The China Clay Trade Review," Benn Brothers, Ltd., 8, Bouverie Street, London, E.C.4. All communications relating to Advertisements, Subscriptions, and other business should be sent to the Manager, "The China Clay Trade Review," at the same address. Telegrams—"Allangas, Fleet, London." Telephone—City 9852 (6 lines).

Contents

Number 8

The opening of No. 8 Great Western Railway Jetty at Fowey marks a milestone in the history of the China Clay industry. We give a fully illustrated account of the ceremony at Fowey on other pages. The conveyor on the jetty is now capable of loading 240 tons of China Clay per hour—very different from the speed maintained 50 years ago—and this points to the rapid increase in trade in Cornwall's premier industry. Mr. Felix Pole, the Great Western Railway general manager, stated that the interests of the company and the China Clay industry were closely bound together, and so convinced were the railway authorities of the steady expansion of the trade in the future that in building the jetty and conveyor, which cost £300,000, provision had been made for doubling the loading capacity when necessary.

At the actual ceremony a small boat was used for demonstration purposes, but lying close by was a Japanese steamer which has since loaded over 8,000 tons of China Clay—probably a record loading for one ship. With the settlement of European troubles will come world-wide demands for China Clay, which Cornwall should be able to supply more economically and with greater dispatch than any other country in the world.

We once heard someone ask if the town of Bournemouth (which has had a very rapid growth) was "made" by the South Western Railway Co., or the Railway Co. "made" by Bournemouth. The answer was that neither could do without the other, and that both had done their best to the mutual advantage of both. The same thing applies to the China Clay trade and the Great Western Railway Co. There was a time when the trade was impatient of delays (often quite unavoidable) in the building of new jetties, and visits and letters of protest to Paddington were frequent and numerous, but throughout the whole of this time of waiting nothing but the best of goodwill existed between the officials of both sides. It is admitted that the Great Western Railway Co. are doing all in their power to facilitate the quick dispatch of China Clay. The China Clay producers appreciate this, and are building up a big business the world over which will be to the mutual profit of both railway company and industry.

We are glad to see an improvement in the deliveries by rail in September—over 5,000 tons being despatched this way. There are indications that the Home Paper Mills are also realising the great possibilities of China Clay in paper-making. The United States have for many years used coated papers for daily newspapers and magazines, and on he Continent the vogue is spreading.

Loading Charges

The statement made by Lord Mildmay of Flete, a director of the Great Western Railway Company, that the loading charges at Fowey, standing at 125 per cent. above pre-war level, would on and after October 1 be reduced to 100 per cent., was received with applause by the China Clay producers gathered together at the luncheon at Fowey Hotel. Afterwards some little doubt was expressed as to who would receive the benefit of this reduction, and with a view to making this quite clear, we asked Mr. Felix Pole for information. He says, "re the reduction as from October 1 in charges raised under Clause 26 of the Fowey Shipping Regulations from 125 per cent. above pre-war level to 100 per cent.: the benefits of this reduction will be felt directly by the ship brokers and shipping agents. In order that you may appreciate exactly what charges are involved, I am enclosing a copy of the Fowey Shipping Regulations and charges referred to."

Clause 26 reads as follows:—

The charges for trimming China Clay, China Clay sand, China Stone, stowage of China Clay (in casks and bags), and China stone runners, on board steam and sailing vessels, and discharging coal cargoes at the company's jetties will be in accordance with the following scale:—

Trimming China Clay, China Clay Sand, China Stone (except China Stone Runners) in Bulk.

Vessel's Burthen.	Steamers. Per ton.	Sailing Vessels. Per ton.
Up to 500 tons	1¾d.	1½d.
500 to 750 tons	2d.	1¾d.
750 to 1,000 tons	2¼d.	2d.
1,000 to 1,500 tons	2¾d.	2½d.
1,500 to 2,000 tons	3¼d.	3d.
2,000 to 3,000 tons	4¼d.	4d.
Above 3,000 tons	4¾d.	4½d.

Stowage of China Clay in Casks and Bags and China Stone Runners.

Vessel's Burthen.	Steamers. Per ton.	Sailing Vessels. Per ton.
Up to 1,000 tons	4¼d.	4d.
1,000 to 2,000 tons	4¾d.	4½d.
2,000 to 3,000 tons	5¼d.	5d.
Above 3,000 tons	6¼d.	6d.

Discharging Coal Cargoes.

Vessel's Burthen.	Steamers. Per ton.	Sailing Vessels. Per ton.
Up to 1,000 tons	5¼d.	5d.
1,000 to 2,000 tons	5¾d.	5½d.
2,000 to 3,000 tons	6¼d.	6d.
Above 3,000 tons	6¾d.	4½d.

Dated September, 1923.

This is welcome news, and should lead to indirect benefits to the producer. The direct result will be to induce more and larger ships to visit Fowey.

The Great Western Railway are to be congratulated upon a forward policy, and the China Clay producers in having a railway who realise the possibilities of the future.

The New Great Western Railway Jetty at Fowey

Proceedings at the Opening Ceremony

At the invitation of the Great Western Railway Co., we journeyed down to Fowey for the opening ceremony of No. 8 Jetty on September 27 last. With their usual courtesy the Railway Co. had provided with their invitations first class return tickets available for one month, thus giving us the opportunity of visiting those of our friends in the China Clay industry who were prevented from attending the gathering at Fowey. In the train luncheon car on the way down to Fowey we met our old friend Mr. Kitchen, of Simpson, Spence, and Young, shipbrokers, London, who is well known to many China Clay producers in Cornwall. Mr. Kitchen told us many interesting tales in connection with the chartering of ships, and the changes which have taken place from the past to the present. Perhaps some day we may persuade him to write them down for *China Clay Trade Review* readers.

At Fowey we were met by Mr. Carter, of Toyne Carter and Co., shipbrokers of Fowey, who came up with us in the Troy Town motor bus to the Fowey Hotel. A word of praise is due to the driver of that bus. For those who have never visited Fowey, we would say that in the main streets no two vehicles can pass, and that the gradients at some points must be 1 in 4 with hair-pin bends. At one part of the drive the bus had to be put in reverse twice before we could turn the bend, so narrow are the streets. Who will ever forget the wonderful view over the Harbour from the balconies of the Fowey Hotel? No wonder the hotel was still full of visitors. Mr. Kitchen, who had never before been to Fowey, was lost in admiration of the view.

The following morning, Mr. Carter took us, together with Captain Collins, the Fowey Harbour Master, in his motor boat round the Harbour, and we were thus able to obtain an excellent idea of the loading facilities of not only No. 8 Jetty, but also the others passed on the way. On the return journey we passed Mr. Parkyn of Parkyn and Peters, St. Austell, being rowed down to catch the special train provided to take the G.W.R. guests to No. 8 Jetty.

At Fowey station began the "gathering of the clans." Car after car unloaded China Clay producers. Most of them had come some distance, yet almost "everyone who is anyone" in China Clay land was there. At 11.45 the special was loaded with visitors, all arrangements for our comfort being looked after by the genial station-master of Fowey. As the train steamed alongside the Jetty we could see the Great Western Railway Officials and others waiting to greet their guests. Lord Mildmay of Flete, Sir Arthur Quiller Couch, Mr. Felix Pole, Mr. Roger T. Smith, and many others were there.

The ceremony itself was very informal. A truck of clay was up-ended and emptied to the silo, the belts started, and the clay was carried over the belts to the ship. The guests were then invited to view the working of the conveyor from the inside, and those who climbed to the top had a good idea of the operations of conveying clay, though most of them were covered with finely powdered China Clay.

The New Jetty and Conveyor

Now a word about the new jetty and conveyor. The cost of creating the new jetty and conveyor was approximately £300,000. The jetty was constructed by the Cleveland Bridge and Engineering Co., of Darlington, and is of steel and masonry super-structure on steel cylinders sunk into solid rock, the length of which is 500 feet from shore to end, about 300 feet straight and 50 feet wide.

The conveyor is electrically operated from the existing generating station which has been enlarged and in which additional machinery has been installed. Trucks are taken on to a table and electrically tipped, the clay is deposited in the silo, from which an endless band conveys it to an elevated platform where the clay is transferred to a horizontal bank working to a portable tower and thence through a chute into the hold of the ship. This tower traverses the greater part of the length of the jetty, and can be moved from hatchway to hatchway to avoid vessels having to be shifted when once it is moored to the jetty. Time lost in moving the ship to bring the hatchway under the chute is thus saved and loading expedited. The chute can be raised or lowered according to the height of the vessel out of the water, and it can be raised to sufficient height to clear any ship's side when light and on the top of the tide. At the end of the chute is an adjustable trimming nose to enable discharge of clay into the hold to be made over wider area, and so save a great deal of hard trimming.

The rate of travel of the inclined belt is about 125 feet per minute. The horizontal belt slightly faster to avoid possible congestion of clay at the point of transfer. The rate of loading is 200 to 240 tons an hour according to the speed at which trucks can be brought to the tipping table and clay deposited in the silo. The silo has a double steel casing with concrete filling, this being provided on account of part of the silo being several feet below water mark. The silo is also constructed on cylinders sunk into solid rock. The sidings are laid along the whole length of the jetty.

A movable three ton electric portal crane is provided to enable cask or bag clay to be loaded into the vessel simultaneously with loading of bulk clay by the conveyor, trucks being passed through the crane legs as required. The working of trucks is done by electric capstans and reels, in lieu of the old system of horse shunting, the work thereby being done more quickly.

Land has been purchased, the hillside cut away, and additional sidings to hold about 200 trucks provided to make feeding of the conveyor as continuous as possible. Any ship capable of being dealt with at Fowey Harbour can be handled at this jetty at all tides.

The conveyor was designed by the company's electrical engineer, Mr. Roger T. Smith. The jetty was designed by the company's chief engineer, Mr. W. W. Grierson. The conveyor was built by Spencer and Company of Melksham. Both the conveyor and silo are designed so as to enable it to be duplicated readily if China Clay traffic grows to such dimensions as to call for this being done.

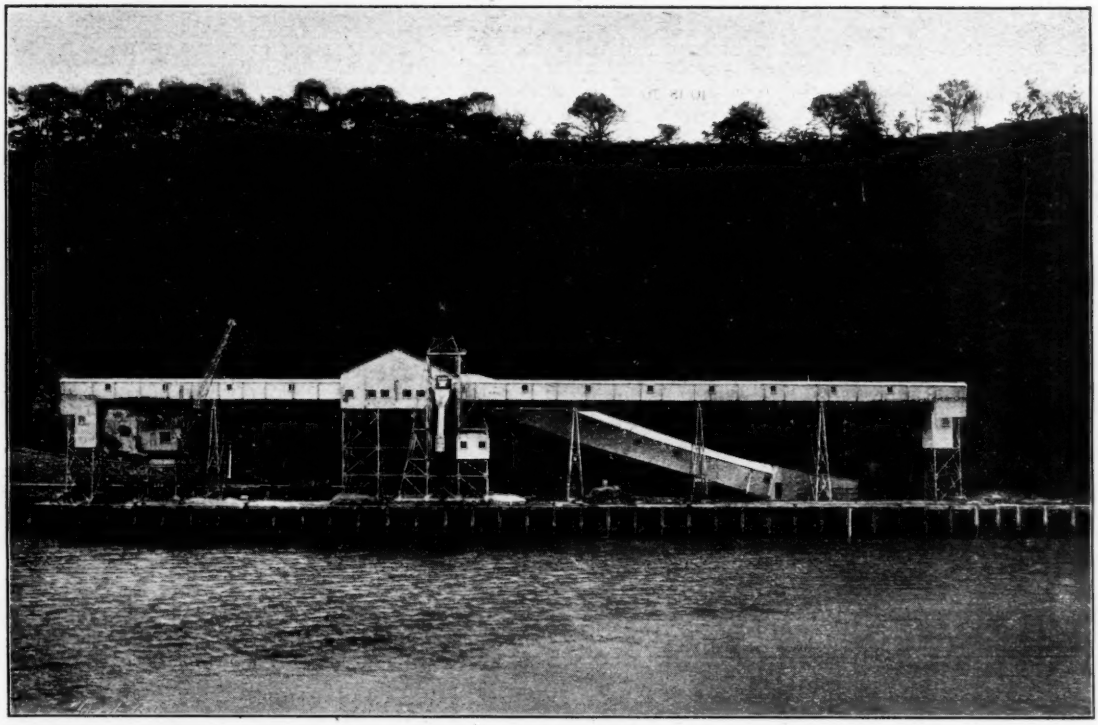
Speeches at the Luncheon

After the inspection of the jetty and electrical appliances, the party were taken on board the tug *Cruden Bay* to the Fowey Hotel, where an excellent lunch was provided by the Great Western Railway Co.

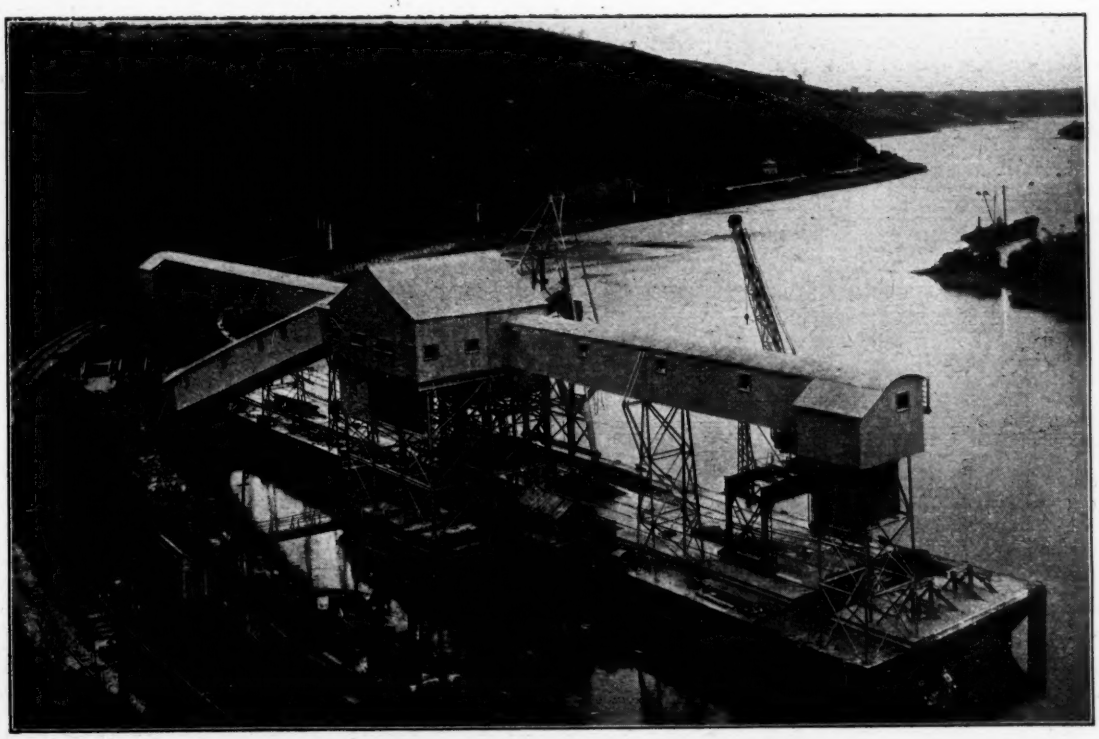
Lord Mildmay who presided, made the welcome announcement "that the whole of the loading and unloading charges now standing at 125 per cent. above pre-war rates will be reduced to 100 per cent. on and from Monday, October 2." His Lordship regretted that the chairman of the Great Western Co., Viscount Churchill, who had taken such a keen interest in the new jetty and the industry generally, was unable to be present at that inauguration. The original jetties only served small ships, said his Lordship, and it was not until the Great Western Railway took over the whole system that an important move was made. The electric conveyor installed on No. 4 jetty, which was erected in 1900, had made it possible to load from 200 to 240 per hour as compared with 200 or 300 tons a day under the old conditions. He had been told that their recent developments had resulted in as much shipping being done in one day as could formerly be done in a week. The success of that conveyor resulted in the attraction of many boats with a capacity for thousands of tons, enabling them to load direct to American and other ports instead of sending it to Liverpool and elsewhere for transference to larger vessels. Still greater improvements had been made by the new conveyor which he regarded as a rather marvellous production. The expense incurred by the provision of such an extensive apparatus was very heavy indeed, and the Great Western Railway Co. might claim that in its construction they had shown a keen anxiety to promote the prosperity of Fowey and serve the interests of the China Clay industry. The directors recognised that the more facilities they give for railway transport the more business would be done, which would be for the benefit of all concerned.

Sir Arthur Quiller Couch, Chairman of the Harbour Commissioners, said that when he came down the river one evening recently by moonlight, the new conveyor bore a mysterious resemblance to an elephant. The China Clay

No. 8 Jetty at Fowey Harbour



NUMBER 8 JETTY AND CONVEYOR TAKEN FROM THE HARBOUR. THIS JETTY AND CONVEYOR WAS ERECTED UNDER THE AUTHORITY OF THE GREAT WESTERN RAILWAY CO., AT A COST OF OVER £300,000



A VIEW FROM THE SURROUNDING HILLS OF THE BACK OF THE CONVEYOR AND NO. 8 JETTY. THIS ALSO GIVES A GOOD IDEA OF THE RAILWAY TRACK AND THE RIVER FROM THIS POINT.

industry might think that the Harbour Commissioners had not been so progressive as they ought to have been. Twenty years ago the largest steamer that came into Fowey was about 2,250 tons, but last year they were more than double that size. Foreign bound steamers were only 50 in 1903 and last year there were 297, with a tonnage of 230,619. The Commissioners' responsibilities included the safety of the moorings of those larger vessels which visited the port more frequently, and upon this work over £1,000 has been expended in relaying. Sir Arthur also referred to the dredging operations and said that last year over £10,000 was expended on a new dredger which at present was costing £7,000 yearly. Sir Arthur declared that throughout the whole of the 20 years as Chairman of the Harbour Commissioners his negotiations with the Great Western Railway Co. had always been conducted with courtesy and concluded with friendship.

The Mayor or Fowey, (Mr. Simeon Rowe), said that Fowey interests were the Great Western Railway's interests, and referred to the progress made within the Borough since the Town charter had been revised.

Mr. Isaac Foot, M.P., said he never entered Fowey without endeavouring to link its past with the present. He hoped that every boy in Fowey would know what a famous town he lived in.

Mr. R. T. Smith, G.W.R. electrical engineer, in proposing "Prosperity to the China Clay industry," stated that the *Daily Mail* obtained thousands of tons of China Clay from Fowey every year for paper manufacture. Since the middle of the eighteenth century there had been steady advance in the use of China Clay so extensively used at the present time in paper making. The China Clays of Devon and Cornwall were so white that they made even the poorest paper look "quite respectable." The China Clay industry was very fortunate indeed in the fact that they were enabled to ship their clay at the cheapest port in Great Britain and they were also extremely fortunate that circumstances encouraged the Great Western Railway to spend hundreds of thousands of pounds in providing apparatus of such a magnitude—together with miles of sidings—for their benefit, and to make the whole work of transportation run smooth and complete.

Mr. Smith concluded with a suggestion for obtaining cheap electricity which he considered possible for the whole of the industry to use and the supply to be made in bulk to the trade, at such a price that it would pay them to use it, in preference to their own power. It would be to their great advantage to look into it, and the Chief Electrical Commissioner who is a Cornishman and who spends a holiday at Fowey every year, could be relied upon to give them every encouragement to any effort to obtain cheap electricity for the China Clay districts.

Mr. J. W. Higman, one of the Managing Directors of the Associated China Clays, Ltd., responding, said that although there had been a lessening of trade for the past month or two, he was optimistic enough to believe that the remaining months of the year would reach the exports of last year. In 1920, the Associated China Clays, Ltd., exported from Fowey over 700,000 tons, in 1922 686,233 tons, and up to the end of August, 1923, they had shipped nearly 452,600 tons.

Mr. T. Medland Stocker, Managing Director of the English China Clays Ltd., spoke of the happy relationship that existed between the railway company and the China Clay producers, and proposed "Prosperity to the Great Western Railway."

The General Manager, Mr. Felix J. C. Pole, in response, observed that the interests of the China Clay industry and the Great Western Railway were one, and said that the Company had endeavoured for some years to do its interests for the trade and benefit of the China Clay community. Mr. Pole proceeded to give a very illuminating speech on the difficult problems the Railway Companies were confronted with on the relinquishment of Governmental control and the gigantic works they had in hand, both for the extension of business and the provision of employment.

The China Clay industry was largely represented, and all who participated in the auspicious function were greatly impressed with the progressive spirit displayed by the Great Western Railway in their effort for the advancement of the China Clay Trade.

The frequent visits of the Chairman of the Company (Viscount Churchill) and the General Manager (Mr. Felix J. C. Pole), together with other railway officials to the China Clay fields have had far reaching results in various ways of transmission, and now with such a marvellous mechanical transporter, shipping will be greatly accelerated. The whole of the industry is now highly organised and in a state of preparation to meet the greatest demand, and with a return of the lost markets on the Continent the industry is destined to engage in far greater prosperity than those memorable years before the Great War.

The photos of the opening ceremony at No. 8 Jetty on the opposite page are as follows :—

1. A group of Great Western officials and China-Clay producers, amongst whom will be seen, Mr. Walter Sessions (English China Clays, Ltd.), Mr. Felix Pole (General Manager G.W. Railway), Mr. Roger Smith and others.
2. Lord Mildmay of Flete being shown the Conveyor by Mr. Roger Smith.
3. Loading the China Clay into the hold of the Demonstration ship.
4. Lord Mildmay of Flete starts the Conveyor working.
5. Up-tipping a truck of China Clay into the silo.
6. Inside the Conveyor. The China Clay is conveyed on long rubber bands to the top of the Conveyor and from there shot down into the hold of the ship.

Paper Dyeing

In the course of a lecture recently delivered on the above subject by invitation of the Association of Swedish Cellulose and Paper Engineers, Dr. Emil Heuser, professor at the Darmstadt Engineering College, referred to some interesting investigations carried out by himself and his assistants. Whereas in the case of former research work on the dyeing of paper only the behaviour of the fibre to the dye had been taken into account, it was now decided to ascertain the behaviour of filling substances, of which many papers contain considerable quantities, with regard to coal-tar dyes.

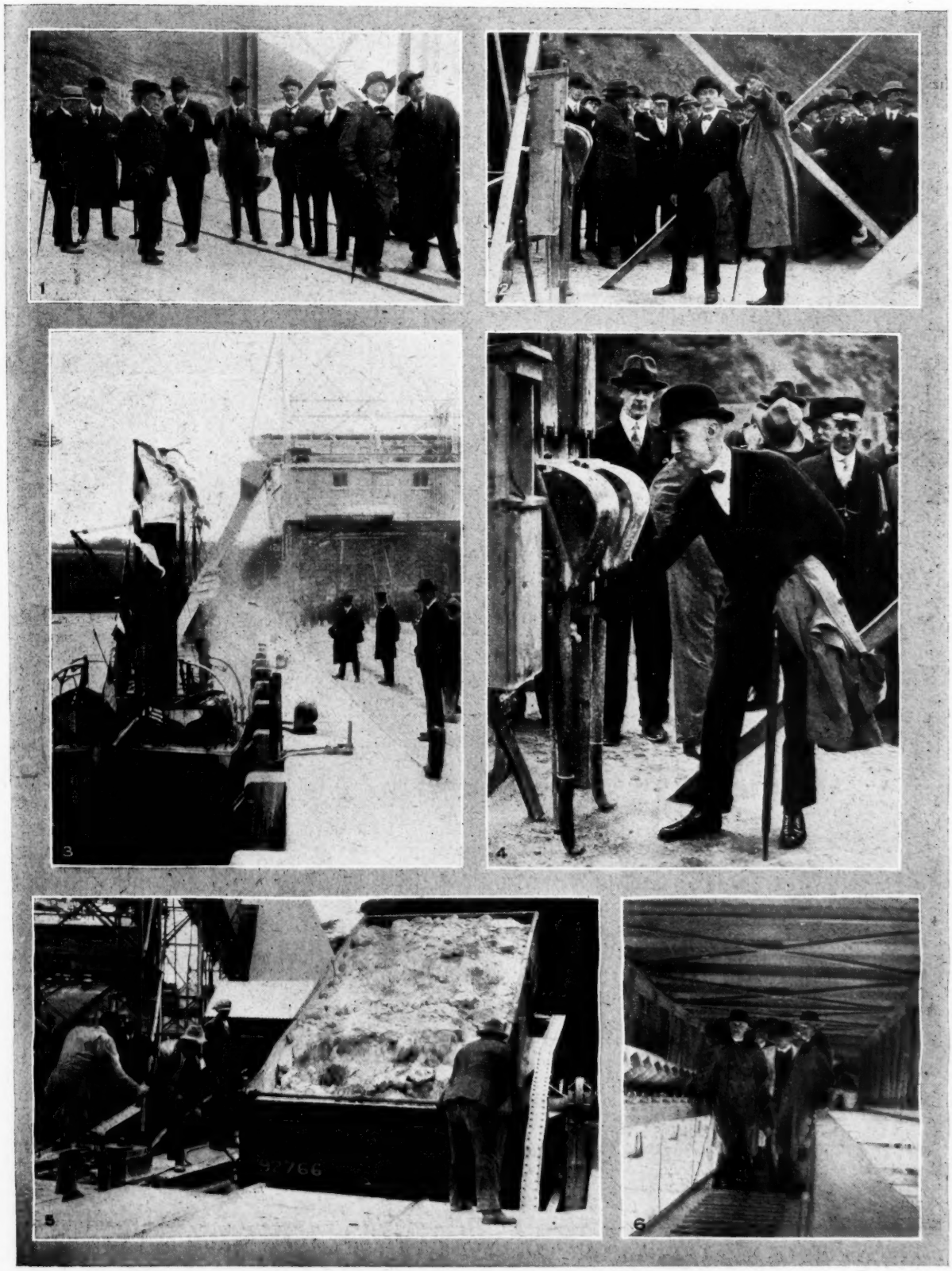
Fundamental investigations on this subject were first undertaken by Heuser and Schubert some years ago, when the following results were obtained: Of the commoner filling substances, such as China clay, kaolin, clay, talcum, asbestine, and blanc fixe, the acid silicates will absorb most readily basic and substantive dyes, while acid dyes are absorbed by them in much smaller amounts. Whereas acid dyes used in connection with silicates and blanc fixe can be washed out, acid silicates treated with basic and substantive dyes were found to be quite fast.

As the filling substances improve the fixing of certain dyes by the paper pulp, the choice of materials should be made with due consideration of these results, the use of acid dyes being discarded in the case of paper loaded with acid silicates. Dyed papers, on the other hand, should not be loaded with blanc fixe. Apart from the class to which a given dyestuff belongs, its composition, especially the size of its molecule, plays a certain part in its behaviour to filling substances. It seems as though also in the case of basic and substantive dyes only those of a complicated composition and great molecular weight are able to ensure fast dyeing with acid silicates.

Another series of investigations recently carried out at Darmstadt was intended to obtain satisfactory absorption of dyestuffs in the filling substance by producing both the filling substance and the dyeing within the paper pulp. This, in the case of silicates, was effected by mixing the pulp first with the dyestuff solution, afterwards with a solution of water-glass (supplying the silicate), and finally with the filling substance, such as aluminium sulphate, calcium chloride, magnesium sulphate, etc. The chemical reactions produced in this manner actually led to the result desired, the dyestuff being precipitated on the pulp fibre as a drop colour and fixed very well, so that a high filling substance output and a very rich and fast colour were obtained.

Canada as a China Clay Market

Within a year Canada will be the world's greatest producer of newsprint paper. This prediction is made by the Dominion statistician in a report on the pulp and paper industry of Canada for 1922, just issued. This report values the year's output at £31,157,077, an increase of more than £800,000 on the production of 1921. There were in operation, according to the report, 104 mills, of which 43 manufacture pulp only, 38 produced paper only, and 28 were pulp and paper mills combined. The quantity of pulp produced in the year was 2,150,251 tons, valued at £16,989,519. The production of paper and paper products totalled 1,366,815 tons, valued at £21,417,153, of which 1,081,364 tons was newsprint paper, valued at £15,154,265.—Reuter.



THE OPENING CEREMONY OF NO. 8 JETTY AT FOWEY. *Photos by Kito, Fowey, and Topical.*

(For explanation of photos, see page 10.)

China Clay Notes and News

China Clay Discovery in Canada

In the monthly review of agricultural and industrial progress of the Dominion, issued by the Canadian Pacific Railway, there is an interesting account of a woman's discovery of China Clay in Saskatchewan. Miss Helene Paschal, of Regina, studied in the New York School of Ceramics, and opened a studio for china-painting in Regina. The delay and difficulty that she experienced in obtaining the china ware for decoration led her to wonder why Canada was not supplying its own needs in that direction, especially as the three Prairie Provinces alone were paying about 5,000,000 dollars a year in the purchase of crockery ware. She determined, therefore, to do some exploring, and from certain indications she judged that there would be clay of the right type under hills in the South-West of Saskatchewan.

During the summer of 1921 she lived in camp and examined many beds that seemed promising, though when the clay was submitted to experimental tests the results were disappointing. Nothing daunted, however, Miss Paschal returned last year to her search and found further fields. Taking this clay to Medicine Hat during the winter, she found it exactly what was wanted, if feldspar and asbestos could be discovered for fusing with it. The quest for these minerals was successful in Quebec. Miss Paschal promptly secured mining rights, and as the clay beds are very extensive there is every reason to believe that a new and important industry will be developed in Canada.

New Road

The diversion of the road between Stenalees and Roche, which was undertaken by the North Goonbarrow China Clay Co., has been much commented upon by those initiated into the responsibilities of such enterprises. This section of the work, which has cost the company approximately £7,000, was rendered necessary by the directors' decision to develop the works to their fullest capacity, and to unite the two pits. It has given much employment in the locality, and has enabled the company to embark on an enormous task for the removal of overburthen which has provided further employment. In this direction the general managing director, Mr. Hart Nicholls, has received great assistance from Mr. H. S. Hancock, who has acted as surveyor, and succeeded in carrying through the very difficult preliminary negotiations. The North Goonbarrow China Clay Company have also extended their drying kilns, with the result that their yearly production is considerably increased. It is understood that the developments at North Goonbarrow have already exceeded £30,000, but the secret is that this mine produces one of the very best samples in the district, and there is a great demand for it, particularly in America. The achievement of the North Goonbarrow directors would have proved too formidable for many producers, and it is feared that the unemployment would have been much more pronounced if these works were in other hands. The happy relations which have existed between the employees and the managing director have had something to do with the encouragement of the directors in the prosecution of this important scheme of extension. Mr. Hart Nicholls is one of the youngest directors in the industry, but he has shown commercial capabilities which are a credit to the community.

Answers?

The Causerie on China Clay, or, as it was styled, "Clay Ship," which appeared in *Answers* on September 29 cannot be expected to give much satisfaction to those engaged in the industry in Cornwall. It must have caused a wide ripple of laughter to all readers of that influential London weekly who are practically associated with the trade.

The First Tramp Steamer and Now

The first "tramp" steamer to load China Clay was the *Sybil*, which loaded nearly 2,000 tons in January, 1897. Nowadays we have steamers coming into Fowey Harbour to load their 8,000 tons. Last November, 1922, the *Atlantic City* loaded 8,031 tons, and now we have a Japanese ship with over 8,000 tons this month. With reduced loading charges, making Fowey the cheapest harbour in England, we should have many large ships attracted to the harbour.

Switzerland

Paper making, which is carried on chiefly in the North of Switzerland and the cantons of Berne, Soleure, Bâle and Argovie, comprises ten paper mills and two large cellulose works and four average sized. Then there are 22 very small paper or board mills and two for pulp. There are about 40 paper machines working and 56 mill-board machines. Ten works make mechanical pulp, but only one of them exclusively. One mill only produces rag half-stuff, although probably several large writing paper mills make it for their own use. Finally, there are five bisulphite cellulose works, two exclusively producing this product. Apparently parchment and impermeable papers are not made, though the chocolate and agricultural industries should encourage manufacture. Nine mills make writing paper, 10 paper for printing, 5 news, 15 packing, 3 blotting, 9 prepared papers, 23 mill-board and cards (generally small mills). The textile and watch making industries use large quantities of packing paper and board. From 1913 to 1920 imports from Sweden continually increased, but of late years this country has only been able to retain its position in the markets for writing, printing and drawing paper. Paper making is well organised in Switzerland and most of the leading manufacturers have instituted a general sales branch at Lucerne for the home markets. Switzerland possesses a hydraulic power of 2,000,000 h.p., but the forest area is only ¼ hectare (2·47 roods) per inhabitant.

Canadian Bentontite

The Canadian Department of Mines, in its report for the year 1921, deals fully with certain analyses which have been made with the new variety of clay, "bentontite." This substance, which differs from clay in several respects, has hitherto been used as a filler in paper manufacture, but the following further uses have been suggested:—Soap making, in which process it can actually replace a portion of the soap substance; as a filler in rubber, textiles, leather, phonograph records, cordage, pressed and moulded insulations; as an ingredient in gypsum and lime plasters; in ceramics; for replacing in part the bonding clay in abrasive wheels, graphite crucibles, chemical and electrical porcelain; as an adhesive paste; for dehydrating crude petroleum; as a water softener, and base for massage creams; in printer's ink; as a substitute for fuller's earth.

Analyses were taken of eight air-dried samples from five widely separated localities, to ascertain if any definite chemical relationship existed between the several samples; to calculate, if possible, a definite (mineralogical) formula for bentontite; to discover its origin; and to have an accurate and complete record of its composition.

The report states that the calculation of a formula does not appear to be possible at present. This may be accomplished after a microscopic examination has been made. The analyses do not give any definite information as to the probable origin of these clays as it does in the case of kaolin. The probability is that they were derived from highly siliceous rocks, possibly volcanic, which have undergone subsequent alteration. It is thought that the analyses constitute the most complete record of the composition of Canadian bentontite at present available. The water absorption, specific gravity and fusion points of the examples are given in detail, together with the effect of heat upon its colloidal properties.

Fog-Bound

The passing of summer time has not been without its unpleasant incidents, particularly for the first few days, when a dense fog set in early for an evening or two. Five China Clay workers, who were employed at Messrs. Parkyn and Peter's works at Pentruff, had left off about 9 p.m., and were proceeding home in their several directions, when all of them became fog-bound. One man, who had armed himself with a lamp, soon missed the beaten track across the downs, and stumbling over some gorse, lost his lamp, missing his latitude, and after wandering found himself back at his starting point. Two other colleagues, who took another direction, were also unsuccessful in reaching the main road, and after divesting themselves of all their matches, they decided to lie down until dawn or some one came to their

rescue. After some time they heard voices in the di tance, and eventually it was found that it was the other two, who had met with a similar fate and could not find the path leading to the main road. These four men sat down amid the gorseland, none daring to move any farther on account of the proximity of some granite stone quarries and boulders, so these four settled down for the night. Their astonishment can be better imagined than described when their other colleague came to their rescue. This man, who found his way back to the works, procured another lamp and went in search of his comrades, and found the four sitting close to the edge of one of the deep quarries in the district, and if they had made another step their lives would have been imperilled.

China Stone

The China Stone industry has been fairly active, we are informed by one of the managers of an important China Stone Quarry, through our representative who was in the China Stone district a few days ago. This firm had several large orders on hand which were, however, delayed for a few days because of the advance in freights. The increase, however, is not exorbitant, and will no doubt be amicably settled and consignments despatched ere this is in print.

Marriage

Miss Evelyn Sessions, daughter of Mr. Wilfred Sessions, managing director of Newquay China Clay Co., was married to Mr. Leyton Irwin, at the Quaker Meeting House at Truro. A reception was held at the house of the bride's father after the ceremony, at which alarge number of friends were entertained.

English China Clays

THE directors of the English China Clays announce an interim dividend at the rate of 4 per cent. per annum, less tax, on the ordinary shares for the past half-year, payable 3rd October. No dividend was paid on the ordinarylast year.

Wooden or Concrete Mica?

Talking to a China Clay "Captain" the other day, we asked if he preferred the concrete mica to the wooden ones, and he told us that for cleaning purposes he preferred the wood. The clay seems to cling to concrete in a way which it does not to wood. What do other Captains say?

Rubber Latex Paper

Rubber latex in paper making is steadily gaining ground, and one after another we find that paper makers are finding a use for it. The London agent of one of the mills making high-grade writing paper says that the finish given by the addition of a small percentage to their paper makes writing much more pleasant and speedy. It has been successfully added by another maker to the strong manilla papers used for making bank money bags. The effect is to make the paper more supple without taking away from the strength. The price is the same whether made with the latex or without. Some makers have a strong objection to the use of it. With them the mill work goes on its way steadily from day to day and week to week, using the same materials and producing a very limited range of papers of an excellent and regular quality and satisfactory output. Anything that will in any way upset the even working of the mill they are very loath to handle. One maker has said that any mill can successfully use the latex.—*Newspaper World.*

Derelict China Clay Vessel

When the shipwrecked crew of the motor vessel *Airston* landed at Swansea on August 23, they found that their vessel, which they had abandoned, had been found derelict in the Channel, and had been towed into Weymouth. When found, its engines were still running.

Captain Bevan, of West Norwood, the skipper of the *Airston*, said his vessel left Torbay for London with a cargo of China Clay loaded at Fowey on Wednesday morning. When ten miles west of Portland they struck a heavy gale, in which the boat became unmanageable. Heavy seas were shipped, and signals of distress were flown. In answer to these, the Spanish steamer *Artillage* bore down and took the distressed vessel in tow.

The tow rope, however, broke, and, as the storm became still more violent, Captain Bevan decided to abandon the ship.

Reduced Loading Charges

When the Right Hon. Lord Mildmay stated at the Fowey Luncheon that the loading charges were to be reduced, a round of applause greeted his remarks. Possibly the good fare provided helped us to see in his statement more than was meant. Anyway, there was a good deal of questioning afterwards as to the exact explanation of the reduction.

Larger Trucks

Mr. Felix Pole says that he hopes that the China Clay producers will be able to load up in 24-ton trucks instead of 10-ton trucks as at present. This desire is no doubt shared by the producers, provided that the trucks are made no higher than at present. If deeper than at present they would be above the level ot the linlays, and cause trouble, but there seems no reason why they should not be built longer and wider and answer the purpose admirably.

The United States and China Clay

What will U.S.A. take from us this year? Last year they purchased from Cornwall and Devon 289,320 tons of China Clay, but they have twice in previous years exceeded 317,000 tons. The first half of this year 149,680 tons has been purchased by our American friends, so that if we can keep up the same rate for this half-year they will have consumed 10,000 tons more than last year, but still some 17,640 tons short of their record years of 1914 and 1920.

If it had One!

"Such new countries as Ceylon, Australia, Egypt, South Africa and the West Indies, though their calls are small at present, indicate that they, like the other countries, are trying China Clay: for what purpose it would be for the industry's inquiring department (if it had one) to find out, and for its propaganda department (if it had one) to develop." Thus speaks *The Western Morning News*. One after another, the writers in both the trade and daily press are surprised at the lack of enterprise shown by the industry in propaganda work.

English Patents

188,010. IMPROVEMENTS IN OR RELATING TO THE MANUFACTURE OF CHINA CLAY. Nils Testrup and Techno-Chemical Laboratories, Ltd., of 46, Victoria Street, Westminster, London, S.W. October 30, 1922.

A method of manufacturing China Clay according to which clay of large water content is precipitated as by settlement in a tank, centrifugal separation or the like, and the separated water is removed until a desired average consistency is reached, after which the densest clay is removed from the precipitated layer, say, by suitable conveyor or other detaching means, without removal of the wetter portion, and the drying of said denser clay to any desired degree is completed upon a surface heated by compressed evolved vapour. A drier is continuously supplied with clay of the desired uniform consistency, say, by the combined operation in sequence of a plurality of settling tanks, having mechanical removal devices, centrifugal separating means or the like. The clay is refined by carrying it as a fine powder in a moving gaseous medium from which it is deposited in a selected condition.

184,880. IMPROVEMENTS IN REFINING CLAY, ESPECIALLY CHINA CLAY. Plauson's (Parent Co.), 17, Waterloo Place, Pall Mall, London, S.W. August 21, 1922.

Kaolin residues 10 parts, for example, with silicilic acid or other silicates are treated with 86 parts of water containing 1 part of potash water glass in solution, for 5 to 10 minutes in a colloid mill and then allowed to stand for one half to one hour in a tall vessel. In this time the whole of the silicates have been precipitated and practically pure kaolin is present in fine suspension which is so fine that it shows Brownian movement in the ultra microscope and remains suspended for a long time. This was not to be foreseen since it was known that the above kaolin residues are at present considered waste products which have to be thrown away. The above process, however, allows of the recovery of as much as 40 per cent. kaolin, and more, whilst the silicates which are simultaneously obtained are also of high value.

Four Years' Developments at Fowey Harbour, 1919-1923

By Capt. Fred. Collins, D.Sc., ExM.,R.N.V. (Rtd.)

In common with many other seaports which were expanding in the period we now refer to as "pre-war," Fowey, in the years of strife, had perforce to lie dormant until "Mars" had exhausted the nations. In 1919 the Harbour Commissioners and Great Western Railway Company were faced with considerable arrears of maintenance work, and a boom period just approaching that had to be dealt with. Early in the year the Harbour Boards' Staff was reconstructed, the active control being entrusted to younger officials to relieve those grown old in the service. In this period of high freights and lucrative employment, vessels of ever increasing tonnage sought the west-bound Clay cargoes to the United States, principally for ballast to enable them to make fair westerly steaming time, their deadweight capacities being far in excess of the quantities loaded, reaching its peak in vessels capable of lifting 13,000 tons on a load displacement of 18,000 tons. 1919-20 saw the boom period with Fowey generally congested. At one time there were as many as 67 vessels in the harbour either loading or awaiting turn to do so, and many were the sighs and enquiries for the new No. 8 Jetty (just recently inaugurated) from the Clay merchant, ship-broker, and ship-

CAPT. COLLINS, HARBOUR MASTER, FOWEY

owner. In 1920 Fowey catered for and obtained a goodly share of the bunkering trade that followed in the wake of prosperous shipping trying to avoid coal ports afflicted with long stem and sectional strikes of workers.

In this period it was seen that the old system of mooring must give way to another more elastic and capable of carrying the increased tonnage now using the harbour. On more than one occasion ships were moored one ahead of the other in Indian file to facilitate the work of bunkering during times of congestion. Much thought was given to the subject of providing efficient ground tackle, and about this time the provision of a deeper channel was first mooted. A specialist was consulted, but they are always expensive luxuries for a small harbour, so that the Board decided to entrust the making and laying of the new moorings throughout to their own staff. There was no place to make such size moorings as were deemed necessary (22 tons each); there was no gear to lift such weights in the port; and the purchase of plant to do so at the prices then ruling was unthinkable. But the staff evolved a method of building them on launching ways mounted on an old hopper barge (which was condemned previous to 1919) that proved highly successful; and the whole system was adapted to modern needs in a most inexpensive manner. At this period the Board took a general survey of the harbour, for one or two vessels had unexpectedly stuck in the entrance, and so moved nearer to the ultimate deepening of the main ship channel. Prices were high—very high—being double those now ruling, and the lean period supervening (the slump of 1921) Fowey saw large vessels laid up over long periods on the new moorings just provided bringing in some revenue, but the jetties were often empty for days at a time. 1921 saw a reconstitution of the Harbour Board under a new order, with the infusion of new blood from the Borough Council and other representatives. Sir Arthur Quiller-Couch was elected Chairman, and a strong Dredging and Finance Committees were formed with J. de Cressy Treffry, Esq., and Alderman R. Vincent, respective chairmen.

A strong forward policy of development of the main ship channel, the approaches to the new jetty, and the provision of a deep water lay-bye was decided upon. The Board again decided to entrust the working out of their plans to their own staff, and following extensive enquiries among the contracting firms, finally decided to carry out the work direct, purchasing the suitable plant to do so when opportunity offered. 1922 was one of increasing trade and tonnage, it being now very apparent that the so-called "handy steamer" of 1922 was of much greater dimensions than those so called ten years previously.

At mid-summer the Board ordered the inspection of various dredging plant in this country and on the continent, with the ultimate result that an exceptionally fine dredger of the bucket type was purchased in Holland, and towed to the scene of her labours in August. Pessimists there were who declared it foolish to try to deepen the entrance to Fowey Harbour, proclaiming the existence of rocks; in fact one dear old bearded father sadly shook his head, saying, "My dear sir, my father knawed there was rocks there." The Dredging Committee showed their confidence by pushing forward the work. Dredging operations were started in the month of September at the mouth of the harbour as scheduled. It seemed daring to commence a new engineering job with unaccustomed plant and raw crews; but the results prove that given good, loyal and willing crews to work, and efficient supervision, winter dredging in an open estuary is not only practicable but is even sound economics. At all events, by the month of December the long talked of "Bar" at the entrance to Fowey Harbour had disappeared, and was reposing on the ocean bed some two miles away. The dredger had belied her name *Tregeagle*, by cutting a sheer five feet from the bed of the river, permitting free egress to the spring erosions and detritus from the upper reaches. The various strata in the harbour bed are peculiar in the uneven manner in which they are deposited, but it is believed possible and practicable to attain a channel giving 35 feet at high water springs, or 31 feet 6 inches at high water neaps, without dealing with much, if any, of the underlying shillot and rock. Having attained a fair entrance channel the main ship channel to the jetties was straight ahead work. The mud banks from the town quay northward were sliced into, adding 75 feet to the navigable width in a much needed part, boat landings were pushed into Town Quay and at the Albert Quay as *Tregeagle* nosed up harbour. It was noticeable that no one wanted *Tregeagle* or his roaring near their water front, for the odour of the dredged material was at times "high." By the month of July, 1923, exactly 10 months from the commencement of operations, a channel of half the ultimate width was completed in time for the largest vessel (in length) s.s. *Rathlin Head*, that had ever visited the port to sail on a neap tide with a draft of 27 feet 3 inches.

From that time no vessel has had to wait for water over the "Bar," and so keen were the ships to avail themselves of the deeper loading they could hardly wait the necessary surveys. The Railway Company now became anxious to enlarge and deepen the approach to the new jetty to permit of its use by vessels three times as large as originally contemplated, and the Harbour Board generously interpreting their obligations commenced forthwith, the end of September seeing the completion of a channel carrying a depth slightly in excess of the entrance line. Much has been done but much more remains untouched. Fowey can be made a place of delight for merchant, shipowner, yachtsman, worker, and the humble habitant. All that is required is vision and courage, and viewing the accomplishments of the post-war era, we can safely credit Fowey Harbour Board with both these essentials of progress.

Use of Fillers in Paper-Making

The following article by Messrs. Raymond and Bonnet, of the Polytechnic Institute of the University of Grenoble, appears in "Paper."

As is indicated by their name, fillers are mineral substances which are employed in the paper-making process to "weight" the paper. They are incorporated with the paper pulp during the course of its manufacture. The addition of these substances to the pulp performs certain important functions in the finished sheet of paper.

What may be regarded as its main purpose is to fill up the interstices or pores in the paper that are formed when the fibres are felted together to form the paper web. The use of fillers improves the quality of the paper by making it glossy, hard, opaque, etc. Before bleaching powder was discovered, fillers were also employed to produce a white surface on the paper or to increase the intensity of whiteness of the paper. The addition of filling materials to the paper serves to increase its weight with reference to the surface area of a sheet.

Various Fillers Used in Paper-making

Many different filling materials are used in the manufacture of paper. They vary in nature and in composition according to the character of the manufacturing process and the qualities desired in the finished paper. The fillers most commonly used in paper-making are kaolin and talc.

USE OF KAOLIN.—Kaolin is a hydrated silicate of alumina, $AL_2SIO_3H_2O$. It is also known as china clay, pipe clay, etc. It has a specific gravity of approximately 2·2. When examined under the microscope it does not appear in any special form, but the particles of clay are very irregularly shaped.

Kaolin from certain sources must be carefully purified as it is apt to contain sand and other impurities which may make it unsuitable for filling paper, even of the most ordinary quality.

If China Clay contains more than 2 per cent. of sand it is not suitable for use in paper making. In the case of coated papers, the proportion of sand must not be greater than 0·1 per cent.; when fine grades of paper are manufactured, the percentage of sand must not be more than 0·25 per cent., and in manufacturing printing paper the sand in the clay must not exceed 0·5 per cent.

The presence of mica and quartz is also detrimental to the manufacture of paper. Particles of these minerals are apt to get very hard and sharp, and frequently cut through the paper web as it is formed on the paper machine, besides spoiling the appearance of the sheet. The presence of these substances in the paper also serves to increase the wear and tear on the wire and on the surfaces of the calender rolls.

Oxide of iron, which is often found mixed with the kaolin, is absolutely proscribed, as it spoils the appearance of the white sheet of paper on account of its brown colour. Ferruginous clays can, however, be used to good advantage in loading dark coloured packing papers and other products of similar character.

It is rather easy to adulterate kaolin, particularly to make it appear whiter than it really is, by the addition of a blue pigment, either of mineral or organic origin.

The properties that are conferred upon paper by the use of kaolin are many in number and decidedly advantageous. When it is used in a moderate amount it makes the paper more supple and facilitates its finishing. It makes it more opaque and renders it better suited for printing purposes. When the clay is added in too large proportions the paper becomes soft and only slightly resistant to folding or crushing.

Retention of the Fillers

The loading materials that are added directly to the beaters are not entirely retained by the paper fibres. Because of the fact that they are all heavier than the paper pulp, a considerable proportion of them is always lost. The amount lost depends on the character of the loading material, the nature of the paper fibres and the condition and slowness of the pulp. There are also losses caused by the shaking of the wire on the paper-making machine and the action of the suction boxes in removing the water from the pulp on the wire.

Loading materials always show a tendency to separate from the pulp because they do not mix well with it. This tendency is very noticeable in the manufacture of coated papers, as these require an excess of sulphate of alumina, which tends to increase the loss of filling material, due to the fact that the presence of the salt in excess in the water of the beater enhances the deposition of the filler.

The more the pulp is beaten, the greater the degree of hydration, and hence the slower the pulp and the more it will retain the various loading materials that are added to the beater. This is due principally to its viscous condition and the difficulty with which it is made to part with its water on the wire and the suction boxes.

Loss of Filler

The loss of filling material varies in accordance with its character. Certain experiments have been made to determine this loss. In these tests all the conditions, such as the incorporation of the loading material, the composition of the pulp, the beating operation, the shaking of the wire, the speed of the machine, etc., remain the same. The results of these experiments are given in the following tabulation:

Kinds of paper	Weight per sq. meter	Amount of filler added	Percentage remaining in Paper: Kaolin	Precipitated CaSO	Blanc fixe	Talc	Asbestine
Writing paper.....	85	30	15·52	15·56	13·93	15·72	16·98
Postal card	200	9	4·93	4·96	4·72	4·98	16·98
Letter paper	80	20	11·30	12·20	11·11	11·30	16·98
Scratch paper	80	17	8·52	8·54	7·31	8·53	9·19
Typewriter paper ...	60	10	4·63	5·10	4·14	4·72	9·19
Semi-fine paper.....	70	35	19·10	91·90	4·14	21·10	21·18
Coated printing.....							
Coated printing paper	130	55	27·10	28·80	4·14	30·19	30·23
Drawing paper	205	12	5·04	28·80	4·93	30·19	30·23

When old papers are used, it is good practice to process them in an edge runner with hot water in order to dissolve out the glue and sizing materials that they may contain and in this way to loosen the fibres so that they will absorb the loading materials added to the beater.

The nature and quantity of the filler varies in accordance with the character of the paper that it is desired to manufacture and the uses to which it is going to be put. It is conceivable that sometimes very large proportions of fillers that are added to the paper pulp are not without their effect on the paper that is made from the pulp. There is a limit to the amount of loading material that may be added to the pulp in each individual case, dependent on the conditions under which the filler is used.

From the standpoint of physical properties the fillers have an injurious action on the resistance of the paper to folding more than on its resistance to rupture.

From the standpoint of durability of the paper, the filling materials, being mineral substances and chemical compounds of a high degree of stability, are not subject to deterioration, and consequently have practically no influence on the durability of the paper, at least when they do not contain harmful impurities, such as acids, etc. It is a difficult matter to establish rigid rules for the use of filling materials, and particularly with respect to the quantity to be employed in paper-making processes. In fact, any rules are apt to vary considerably under different conditions, owing to the complication of factors that affect their application and which have a great influence on the proportion of the filling materials that remain in the manufactured paper.

When boiled starch is employed along with the filling materials the paper fibres retain more of the filler. Tests have been made which indicate that when the kaolin filler is cooked with 5 per cent. of starch before being added to the paper pulp, more than twice the proportion of filler remains in the paper than is retained when the kaolin is merely mixed with water and used in that state.

The determination of the percentage of filler retained in the paper is comparatively easy. All that is necessary is to burn the paper and weigh the ash. The weight of the ash obtained in this manner does not represent exactly the filler contained in the paper, as it is necessary to take into account the ash formed by the paper fibres, the size, etc. It is also necessary to take into consideration the chemical reactions that occur during the calcination of the filler, such as evolution of water of crystallisation, disengagement of carbon dioxide, etc. A fairly accurate estimate of the percentage of filler can be determined in this manner.

Fillers Used in Various Papers

PRINTING PAPERS.—In this kind of paper the addition of filler is an important means of counteracting the tendency of the paper to stretch, and at the same time the ease of printing on such paper is considerably enhanced, for the reason that the filling materials that are found in the paper facilitate the drying of the printing ink.

Nevertheless, it is necessary to avoid using an excess of the filler, for if that is done, it may result in serious difficulties not only in the calendering of the paper but in printing as well, because the particles of filler become detached from the paper fibres and soil the rprinting forms, type and the rollers.

Loading materials such as blanc fixé are not suitable for printing papers, although they produce a beautiful white. Moreover, on account of their high specific gravity they adhere only slightly to the paper fibres, and consequently the loss in the back waters is very high, in some cases as high as 70 per cent. Kaolin is much more appropriate for this purpose, when a good grade of the mineral, pure and unctuous, possessing a fine shade and especially free of sand, is employed. The filler is generally used in the proportion of 7 per cent.

The best mineral filler that can be used for this purpose is talc, which is very unctuous to the touch and has a particularly good effect on the printing process. In order to obtain a paper which is very opaque and which is especially well suited for book making, a mixture consisting of 5 per cent. talc and 5 per cent. gypsum, figured on the weight of the pulp, is added to the pulp beater.

NEWSPAPER AND TYPEWRITER PAPER.—Formerly newspaper contained only approximately 6 to 10 per cent. of filler, but the necessity of manufacturing this paper in large quantities and at small cost led to increasing the proportion of filler to 25 and 30 per cent. and even more.

Paper that is intended for typewriting is generally loaded with a mixture containing 8 per cent. of kaolin and the same percentage of precipitated barium sulphate, calculated on the weight of the pulp. Good results have also been obtained by using 10 to 12 per cent. of talc as a filler.

Writing paper for school use is generally weighted with about 22 to 35 per cent. of the weight of the pulp of kaolin. Writing paper for letter writing contains on the average from 10 to 22 per cent. of filler. Ledger and record papers contain from 10 to 12 per cent. of loading materials.

Paper used in making geographic maps and charts must contain a large amount of filler in order to make the paper resistant to temperature and humidity influences. The mixture of a little rice starch with the filler enhances the high glossy surface that such papers possess.

Drawing paper does not require a large amount of filler, in general the ash from this paper should not exceed 10 to 12 per cent. Barytes is preferred to all other loading materials for weighting this class of paper. It appears to make the surface of the paper more slippery.

When laid paper is made entirely from rags it is customary to use only a little filler, not more than 20 per cent., and under certain conditions no filler at all. If the laid paper is made from ordinary pulp, then fillers are always employed up to as high a proportion as 40 per cent.

Photographic paper is not generally loaded with a filler. But it is covered with a coating which is essentially composed of sulphate of barium and gelatine.

COATED PAPER.—The underlying layer of paper in a coated paper should either be loaded with filler up to a maximum of 10 to 12 per cent., or else it should not be weighted at all. This depends on the quality being made. Various minerals are used in the coating process. Precipitated sulphate of barium or blanc fixe, natural sulphate of barium and kaolin are all used for this purpose. Blanc fixe is reserved for the finest grades of coated paper, while kaolin is used in manufacturing the ordinary grades. These mineral substances are employed in admixture with a solution of glue, gelatine or casein of variable concentrations. Generally one kilogram of gelatine is used for every eight to ten kilograms of filler.

Chrome paper is loaded with approximately 20 to 30 per cent. of filler. In the case of wall paper a soft paper is sought, and hence the latter is weighted with about 50 per cent. kaolin.

In the manufacture of thin papers it is customary to add comparatively little filler, not more than 10 to 20 per cent. This in spite of the fact that mineral matters are well retained by the paper fibres and are not lost in the back water, as is frequently believed. The addition of fillers to thin papers is for improving their appearance rather than for increasing their weight. Kaolin possesses the property of conferring of silk-like rustling effect on these papers. However, it is also possible to employ asbestine for this purpose, as this substance is well retained by the fibres. In every case, no matter what filler is used, it is essential that it be in a finely pulverised condition, for otherwise, when the paper is passed between the calenders and the press rolls the crushed filler will tend to become loosened from the fibres and be lost in this way, giving rise to what is called pin holes in the paper.

Onionskin paper, also known as pelure paper, is generally manufactured without the employment of fillers. However, when they are used, it is customary to employ just a small amount of carbonate of lime.

The paper that is commonly employed in printing bibles is loaded with carbonate of lime, which, although it is not used in manufacturing the highest grades of this class of paper, nevertheless gives the paper a fine, mat surface which makes it particularly well suited for printing. The quantity of filler added to the beater usually varies from 15 to 30 per cent.

Commercial Intelligence

County Court Judgment

[*NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.*]

ANTIQUE GLAZED BRICK CO., LTD., North British Wharf, Great Northern Goods Station, Wood Green, brick merchants. £16 14s. 10d. September 3.

Mortgages and Charges

[*NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

THOMAS BROTHERS AND CO., LTD., Bisham, paper manufacturers. Registered September 21, £15,000 debentures; general charge; also registered September 21, £15,000 mortgage (as further security for debentures), to Mrs. A. A. Thomas, Weir Cottage, Temple, Marlow, and another; charged on Temple Mill, Bisham, etc. *Nil. December 11, 1922.

BARNES (SOUTHSEA), LTD., paper manufacturers. Registered September 28, transfer of mortgage and further charge securing £2,000 (including £1,500 transferred), to H. Brake, Tintern, Bedhampton; charged on 85, Palmerston Road, Southsea. *£2,000. May 30, 1923.

BUSBRIDGE AND CO. (1919), LTD., London, E.C., paper manufacturers. Registered October 2, £4,000 2nd debentures; general charge, subject to £24,000 1st debentures. *£16,000. July 3, 1923.

THOMAS AND GREEN, LTD., Wooburn Green, paper makers. Registered October 2, mortgage and Land Registry charge, to bank; charged on Soho Mill and other properties at Wooburn and Bourne End, and land at Wooburn, respectively; also registered October 2, £60,000 debentures; general charge. *£53,751 0s. 9d. July 10, 1923.

Satisfactions

PORTALS, LTD., Whitchurch (Hants.), paper manufacturers. Satisfaction registered September 20, £30,000, part of amount registered. May 25, 1920.

BUSBRIDGE AND CO. (1919), LTD., London, E.C., paper manufacturers. Satisfaction registered October 2, £8,000, part of amount registered April 14, 1919.

Shipping and Export News of the Month

We give below the latest particulars relating to arrivals and sailings of ships engaged in the China Clay Trade, at the principal British clay ports. Registered exports of China Clay with countries of destination, and other shipping and export matters are dealt with.

Shipping—Fowey, September, 1923

Arrival. Date.		Name.	Sailing. Date.	Destination
Sept. 1,	S.S.	*Multistone*	Sept. 3,	Aberdeen
Sept. 1,	S.S.	*Ualan*	Sept. 7,	Brussels
Sept. 1,	S.S.	*Jarrix*	Sept. 6,	Ridham
Sept. 1,	S.S.	*Pine*	Sept. 5,	Weston Point
Sept. 1,	M.V.	*Anna Elisabeth*	Sept. 11,	Oscarshamn
Sept. 1,		*Rose*	Sept. 19,	Bo'ness
Sept. 1,		*Rise*	Sept. 8,	Gothenburg
Sept. 1,	S.S.	*Condor*	Sept. 6,	Antwerp
Sept. 1,		*James Postlethwaite*	Sept. 21,	Gravelines
Sept. 3,		*Kaj*	Sept. 8,	Fredrickshald
Sept. 3,		*Camille*	Sept. 7,	Nantes
Sept. 3,	M.V.	*Young Fox*	Sept. 6,	St. Malo
Sept. 3,		*Emma and Ernest*	Sept. 11,	Charlestown
Sept. 3,	S.S.	*Barflo*	Sept. 8,	Rouen
Sept. 4,	S.S.	*Norrix*	Sept. 7,	Hull
Sept. 4,	M.V.	*Mary Eliezer*	Sept. 7,	Port aude mer
Sept. 5,		*Harris*	Sept. 9,	Par
Sept. 5,	S.S.	*King Gruffydd*	Sept. 15,	Philadelphia
Sept. 6,	S.S.	*Seaforth*	Sept. 7,	Newlyn
Sept. 6,	M.V.	*Littoral*	Sept. 12,	Antwerp
Sept. 6,	S.S.	*Farfield*	Sept. 8,	Liverpool
Sept. 6,	S.S.	*Calcaria*	Sept. 6,	Gloucester
Sept. 7,		*Bulla*	Sept. 8,	Plymouth
Sept. 7,	S.S.	*Gowestroom*	Sept. 13,	Amsterdam
Sept. 7,	S.S.	*Torfrey*	Sept. 12,	Bilbao
Sept. 7,	M.V.	*De Wadden*	Sept. 13,	Weston Point
Sept. 8,	S.S.	*Kamma*	Sept. 13,	Brussels
Sept. 8,	S.S.	*Falmouth Castle*	Sept. 12,	Runcorn
Sept. 10,	S.S.	*Branstone*	Sept. 13,	Rochefort
Sept. 10,	S.S.	*Cervantes*	Sept. 14,	Genoa
Sept. 10,	M.V.	*Leeuwerik*	Sept. 14,	Hamburg
Sept. 11,	M.V.	*Elly*	Sept. 15,	Karlscronen
Sept. 12,	S.S.	*Freighter*	Sept. 14,	Newcastle
Sept. 12,	S.S.	*Pansy*	Sept. 15,	Preston
Sept. 12,	S.S.	*Idustria*	Sept. 14,	Nantes
Sept. 13,	S.S.	*Hampshire Coast*	Sept. 15,	Liverpool
Sept. 13,	M.S.	*Hibernia*	Sept. 18,	Antwerp
Sept. 13,		*Ivy*	Sept. 15,	Falmouth
Sept. 14,	M.V.	*Berta*	Sept. 18,	Harburg
Sept. 14,		*Jane Slade*	Sept. 21,	Charlestown
Sept. 14,		*Henrietta*	Sept. 27,	Runcorn
Sept. 14,	S.S.	*Condor*	Sept. 19,	Antwerp
Sept. 14,	S.S.	*Eureka*	Sept. 25,	Genoa
Sept. 14,	S.S.	*Mersey*	Sept. 18,	Preston
Sept. 15,		*Emma and Ernest*	Oct. 4,	Kirkcaldy
Sept. 17,		*Raymond*	Sept. 22,	Penryn
Sept. 18,	S.S.	*Venice Maru*	Oct. 2,	Philadelphia
Sept. 19,		*Mary Ann*	Sept. 28,	Weston Point
Sept. 20,	S.S.	*Scartho*	Sept. 22,	Kotka
Sept. 20,		*Alert*	Sept. 28,	Runcorn
Sept. 21,	S.S.	*Teesburn*	Sept. 25,	Rouen
Sept. 22,	S.S.	*Liana*	Sept. 22,	Wachet
Sept. 22,	S.S.	*Teesbridge*	Oct. 4,	Montreal
Sept. 24,	S.S.	*Bro*	Sept. 28,	Kotka
Sept. 25,	S.S.	*Edern*	Sept. 28,	Ridham
Sept. 25,	S.S.	*Mercurius*	Sept. 26,	Gothenburg
Sept. 25,	S.S.	*Falmouth Castle*	Sept. 26,	Falmouth
Sept. 26,	S.S.	*Seaforth*	Sept. 27,	Weston Point
Sept. 27,	S.S.	*Ualan*	Oct. 2,	Brussels
Sept. 27,	S.S.	*Everest*	*	
Sept. 28,	S.S.	*Florentino*	Oct. 5,	Genoa
Sept. 28,		*Jane Slade*	Oct. 1,	Erith
Sept. 29,	S.S.	*Mistley*	Oct. 3,	Brussels
Sept. 29,	M.V.	*Nordo*	Oct. 4,	Kotka
Sept. 29,	S.S.	*Magrix*	Oct. 2,	Newcastle
Sept. 29,	S.S.	*Suffolk Coast*	Oct. 1,	Liverpool

* signifies in Port.

Par Harbour Shipping—September, 1923

Arrivals

Date.		Vessel.	From.
Sept. 1	S.V.	*Lady Agnes*	Scilly
Sept. 6	S.V.	*Irish Minstrel*	Plymouth
Sept. 7	S.S.	*Evelyn Manor*	Plymouth
Sept. 9	S.V.	*Harris*	Gotenburge
Sept. 10	S.S.	*Effie Grey*	Plymouth
Sept. 12	S.S.	*Magrix*	Hull
Sept. 12	S.V.	*Alice Williams*	Charlestown
Sept. 12	M.V.	*Theodora*	Mevagissey
Sept. 14	S.V.	*Edith*	Falmouth
Sept. 15	S.V.	*John Sims*	Cardiff
Sept. 15	S.V.	*Katie*	Portleaven
Sept. 15	S.V.	*Schwan*	Exmouth
Sept. 15	S.S	*Katherine*	Plymouth
Sept. 15	M.V.	*Garlandstone*	Truro
Sept. 15	S.V.	*Weser*	Penryn
Sept. 15	S.V.	*Flying Foam*	Plymouth
Sept. 16	S.V.	*Western Lass*	Looe
Sept. 22	S.V.	*Shoal Fisher*	Truro
Sept. 28	S.S.	*Norrix*	Plymouth
Sept. 28	S.S.	*Tanny*	Bristol

Sailings

Date.	Vessel.	Destination.
Sept. 10	S.S. *Evelyn Manor*	Leith
Sept. 11	S.V. *Irish Minstrel*	Runcorn
Sept. 13	S.S. *Effie Grey*	Reddam
Sept. 14	S.S. *Magrix*	Gravesend
Sept. 14	M.V. *Theodora*	Mevagissey
Sept. 15	S.V. *Alice Williams*	London
Sept. 16	S.S. *Katherine*	Plymouth
Sept. 21	S.V. *Schwan*	Inverkeithing
Sept. 22	S.V. *Harris*	Leith
Sept. 24	M.V. *Garlandstone*	Gloucester
Sept. 24	S.V. *Weser*	Antwerp
Sept. 26	S.V. *John Sims*	Runcorn
Sept. 26	S.V. *Katie*	Rochester
Sept. 26	S.V. *Western Lass*	Glasgow
Sept. 28	S.S. *Norrix*	Gravesend
Sept. 28	S.V. *Edith*	Plymouth
Sept. 28	S.V. *Flying Foam*	London
Sept. 30	S.V. *Shoal Fisher*	Runcorn

Vessels Arrived in August and Sailed in September

Arrivals

Date.		Vessel.	From.
Aug. 10	S.V.	*Regina*	Plymouth
Aug. 23	S.V.	*Success*	Falmouth
Aug. 24	S.V.	*Lizzie Trenberth*	Falmouth
Aug. 28	S.V.	*Two Sisters*	London
Aug. 31	S.V.	*Wilhelmina*	Salcombe

Sailings

Date.	Vessel.	Destination.
Sept. 1	S.V. *Success*	Greenhithe
Sept. 6	S.V. *Wilhelmina*	Gravelines
Sept. 7	S.V. *Regina*	Pentewan
Sept. 11	S.V. *Lizzie Trenberth*	Runcorn
Sept. 11	S.V. *Two Sisters*	Antwerp

Charlestown Shipping—September, 1923

Arrivals

Date	Vessel.	From
September 1	*Leading Light*	Truro
September 3	*Frances and Jane*	Newlyn
September 4	*Isabella*	Fowey
September 8	*Halton*	Cowes
September 9	*Alice Williams*	London
September 11	*Emma Ernest*	Fowey
September 10	*Elise*	Frangsand
September 11	*Dronning Louise*	Nederkales
September 12	*Louistic*	Nantes
September 21	*Pursuit*	Penrhyn
September 24	*Valonia*	Plymouth
September 26	*Jane Slade*	Fowey
September 28	*Balmyle*	Plymouth
September 28	*Heatherlea*	Exmouth

Sailings

Date.	Vessel	Destination
September 5	*Leading Light*	Rochester
September 7	*Isabella*	Antwerp
September 10	*Frances and Jane*	London
September 11	*Halton*	London
September 13	*Emma Ernest*	Kirkcaldy
September 21	*Louistic*	Nantes
September 25	*Dronning Louise*	Gothenburg

September 27.....	*Pursuit*	London
September 27.....	*Valonia*	London
September 27.....	*Jane Slade*	London
September 23.....	*Elise*	Drammen
September 29.....	*Balmyle*	Barrow
September 30.....	*Heatherlea*	London

Par Harbour Tide Table, October, 1923

(Greenwich Mean Time throughout.)

Day of Week.	Day of Month.	Morning.	Afternoon.	Height.
Monday	1	8.34	8.52	10.11
Tuesday	2	9.12	9.34	10.3
Wednesday	3	9.59	10.28	9.8
Thursday	4	11.3	11.43	9.3
Friday	5	—	0.26	9.5
Saturday	6	1.10	1.50	10.3
SUNDAY	7	2.26	2.58	11.4
Monday	8	3.26	3.51	12.6
Tuesday	9	4.15	4.38	13.5
Wednesday	10	5.0	5.22	14.2
Thursday	11	5.44	6.6	14.4
Friday	12	6.28	6.49	14.5
Saturday	13	7.9	7.30	14.1
SUNDAY	14	7.52	8.14	13.4
Monday	15	8.36	9.0	12.4
Tuesday	16	9.26	9.54	11.3
Wednesday	17	10.25	11.1	10.4
Thursday	18	11.41	—	9.10
Friday	19	0.25	1.8	10. 1
Saturday	20	1.47	2.22	10.8
SUNDAY	21	2.53	3.21	11.5
Monday	22	3.46	4.7	12.1
Tuesday	23	4.27	4.46	12.5
Wednesday	24	5.4	5.21	12.9
Thursday	25	5.37	5.53	12.9
Friday	26	6.9	6.24	12.9
Saturday	27	6.39	6.53	12.7
SUNDAY	28	7.7	7.22	12.3
Monday	29	7.38	7.53	11.8
Tuesday	30	8.9	8.26	11.5
Wednesday	31	8.45	9.6	10.6

H. L. VICKARY, Harbour Master.

Countries of Destination (August, 1923)

RETURN showing the exports of China Clay (including Cornish or China Stone), the produce or manufacture of the United Kingdom, from the United Kingdom, to each country of destination, registered during the month ended August 31, 1923.

COUNTRY OF DESTINATION.	QUANTITY. Cwts.	VALUE. £
Finland	1,051	1,841
Latvia	406	1,051
Sweden	1,066	2,283
Denmark	817	2,297
Germany	1,140	2,966
Netherlands	2,650	6,891
Belgium	10,112	20,039
France	2,273	5,213
Switzerland	195	454
Spain	936	3,027
Italy	780	2,340
United States, Atlantic	41,509	95,707
United States, Pacific	187	681
Mexico	50	200
Uruguay	2	10
Bombay, *via* Other Ports	616	2,461
Madras	60	240
Bengal	32	128
Ceylon	50	200
Western Australia	1	5
Victoria	24	150
New South Wales	40	288
Canada, Atlantic	325	880
Newfoundland	2,489	4,600
Total	66,811	153,952

A Return showing the Registered Imports of China Clay (including Cornish or China Stone) into Great Britain and Northern Ireland from the several countries of consignment during the month of August, 1923.

COUNTRIES WHENCE CONSIGNED.	QUANTITY. Tons.	VALUE. £
Channel Islands and Total	220	330

Countries of Destination (Sept., 1923)

THE return showing the exports of China Clay, the produce of manufacture of the "United Kingdom" from the "United Kingdom" to countries of destination registered during the month ended September 30, 1923.

COUNTRY OF DESTINATION.	QUANTITY. Tons.	VALUE. £
Finland	225	552
Esthonia	484	676
Sweden	1,599	2,931
Norway	367	995
Denmark (including Faröe Islands)	262	575
Germany	692	1,988
Netherlands	358	1,011
Belgium	4,662	8,760
France	4,271	8,660
Spain	2,334	8,206
Italy	1,898	5,694
China (exclusive of Hong Kong, Macao and leased territories)	10	40
United States of America	21,881	53,827
Mexico	25	111
Peru	15	60
Chile	25	112
Irish Free State	9	25
Natal	—	1
Other Ports	1,001	3,996
Madras	48	190
Bengal, Assam, Bihar and Orissa	83	333
Victoria	21	62
New South Wales	10	39
Canada	1,581	2,841
Total	41,861	£101,685

NOTE.—As regards goods registered on and after April 1, 1923, the expression "United Kingdom" does not include the Irish Free State.

Antwerp Arrivals

China Clay, Stone and Ball Clay arrivals in Antwerp for September as follows:—

From:				
Poole	s.b.	*Alan*	150 tons	Sept. 1
Fowey	s.s.	*Artificier*	370 tons	Sept. 1
Teignmouth	sch.	*Bidsie*	320 tons	Sept. 2
Fremington	s.s.	*Orleigh*	460 tons	Sept. 1
Plymouth	s.b.	*Hilda*	374 tons	Sept. 4
Poole	m.s.	*Moultonian*	220 tons	Sept. 10
Teignmouth	sch.	*Carmenta*	284 tons	Sept. 12
Fremington	s.s.	*Orenie*	500 tons	Sept. 13
Charlestown	sch.	*Isabella*	175 tons	Sept. 13
Fowey	s.s.	*Littoral*	250 tons	Sept. 15
Par	sch.	*Two Sisters*	208 tons	Sept. 16
Poole	sch.	*Waterwitch*	300 tons	Sept. 17
Fremington	s.s.	*Orleigh*	550 tons	Sept. 17
Poole	s.b.	*Gladys*	140 tons	Sept. 17
Poole	s.b.	*Vicunia*	160 tons	Sept. 18
Teignmouth	sch.	*M. A. James*	206 tons	Sept. 20
Fowey	s.s.	*Condor*	450 tons	Sept. 21
Fowey	m.s.	*Hibernia*	323 tons	Sept. 21
Teignmouth	slp.	*Clymping*	212 tons	Sept. 28

September China Clay Deliveries

WHILE there was a drop of nearly 1,500 tons in the deliveries of China Clay through Fowey as compared with August, in consequence of increased deliveries by rail and through other ports, there was an increase in the total deliveries, compared with the total deliveries for August of nearly 1,500 tons. The details are as follows:—

Port.	Tonnage.
Fowey	47,932
Par	4,105
Charlestown	3,650
Plymouth	709
Penzance	670
	57,066
By rail throughout	5,132
Total tonnage to all parts	62,198

Compared with 60,775 tons for August. Total deliveries for the nine months 617,353 tons, compared with 470,085 tons for the corresponding nine months last year.

The China Clay Trade Review

The Official Organ of the China Clay Industry and the only Journal specially devoted to its interests. Published in the third issue of "The Chemical Age" each month.

All Editorial communications should be addressed to the Editor, "The China Clay Trade Review," Benn Brothers, Ltd., 8, Bouverie Street, London, E.C.4. All communications relating to Advertisements, Subscriptions, and other business should be sent to the Manager, "The China Clay Trade Review," at the same address. Telegrams—"Allangas, Fleet, London." Telephone—City 9852 (6 lines).

Contents

China Clay Salesmanship

The difficulty the China Clay producer has to contend with in finding an efficient and clever representative—a man with a thorough knowledge of the trade, combined with an engaging and forceful personality—must be as great as, or perhaps greater than, that experienced in any other trade. The many different brands of China Clay on the market, and the many different trades using the material, make it almost essential that an outside representative should have had a practical training, if he is to be of the highest service to his firm. Often a knowledge of several languages is required. The best and cheapest way of transport and a great many technical questions are bound to be asked by the consumer. The representative who has constantly to refer to his firm for such information is sadly handicapped in his fight for trade. If China Clay producers had in the past taken a longer-sighted view and trained up their young men and boys for these posts, placing them through every department, from the pits to the office, we should now find many abler salesmen in the China Clay industry.

There is much to be said for the old days of apprenticeship, with all its drawbacks. It did turn out men who had a very thorough knowledge of their trade. The Salesmen's Association of the Paper Industry have issued a folder which is intended for distribution by paper salesmen to their clients. We find under the heading "We Believe" "That a salesman should be well enough informed to *advise* when, what, and how much his customer should buy, and honest enough not to oversell him."

The second portion of the folder defines a real salesman as—

> One who has a steady eye, a steady nerve, a steady tongue and steady habits; one who understands men, and who can make himself understood by men; one who turns up with a smile, and who still smiles if he is turned down; one who strives to out-think the buyer rather than to out-talk him; one who is silent when he has nothing to say, and also when the buyer has something to say; one who takes a firm interest in his firm's interests; one who keeps his word, his temper and his friends; one who wins respect by being respectable and respectful; one who is loved by his fellow-men.

A salesman without knowledge of his trade is like a ship without a rudder, and is soon hopelessly lost. We commend to the China Clay producers the idea of training up their own outside representatives in a thorough practical knowledge of the trade before placing them in the position of seeking orders.

English and Foreign Clays

English China Clay was at one time (during the War) badly hit by American kaolins, which were greatly helped through the conditions prevailing during the War, when regular and continuous deliveries of English China Clays were interrupted by the submarine menace and other war restrictions. But despite the war time and post-war exploitations of the domestic clays of America, the new tariff recently passed, in the face of powerful manufacturing interests in that country, who argued that China Clay consuming industries would be injured thereby, it has been found by experience that except in the cheaper grades of China Clay American domestic clays are incapable of holding their own with English China Clays.

The end of last year and the beginning of this year, before the French Reparation crisis became acute, French China Clay markets were reviving, and even German buyers were beginning to place orders for China Clay to a greater extent than at any time since the War. Consignments to Germany were beginning to run into thousands of tons a month, but these, since the French domination of the Rhineland, have dwindled. The revival in the French markets for China Clay has also been a branch on which foreign makers have generally concentrated. European makers adapt their paper machines to the use of a cheaper grade of clay on a much larger scale than do British makers, hence possibly their success in the cheap paper trade market. It might be worth the while of British makers to follow the example of the Continental competitors in this respect.

A China Clay Research Scheme

The announcement made by Mr. William Rose at a recent meeting of the St. Austell Rotary Club that the South Western University College at Exeter have adopted his recommendation to undertake China Clay research has been received with general satisfaction by the industry. Mr. Rose, who is a China Clay producer himself, and a member of the Board of Governors of the University, in basing his claim for the assistance of the technical experts of the institution on the fact that China Clay is a staple industry of the two western counties and that the Cornwall Education Committee is contributing towards the work of the University, was advocating a departure which it is gratifying to note the University authorities were ready to recognise. As to the need for more information on the chemical side of the characteristics of China Clay and its suitability for purposes other than those for which it is already used, there can be no doubt, and Mr. Rose himself is under no illusion as to the capacity of chemists and technical experts to help the industry. At the present time such research as is undertaken is of a somewhat perfunctory character and is undertaken by individual firms for their own information and business, and does not review the whole field of research, such as that to which the chiefs of the technical section of the University are to devote their attention.

There are numerous instances of the success that has attended researches by particular industries into the

capabilities of China Clay, notably those which led to the discovery of its value in the paper making industry, as a filler, coater and glazer, which industry now uses something like two-thirds of the total volume of China Clay produced. The Germans discovered and developed its use in the manufacture of artificial ultramarine, which revolutionised that industry, while its value in the manufacture of alum, bleaching powders, and other chemicals has led to an ever-increasing demand for this material.

The possibilities of China Clay in chemicals of various kinds are not yet by any means exhausted, and the hope is that the research work to which the Exeter University experts are now to devote their attention will be productive of equally successful results as have attended the researches of manufacturers.

The Chemical Study of China Clays

[*The notes given below are an abstract of an article which appeared recently in "La Ceramique."*]

THE expression "argillous substance" was introduced into the chemistry of clay by Seger. This designation is usually applied to that part of a clay which is soluble in hot concentrated sulphuric acid. Its purest form is found in kaolinite, Al_2O_3, $2SiO_2$, $2H_2O$. Recent researches have demonstrated that the "argillous substance" of Seger does not consist of one single specified combination, but is composed of different groups of combinations which more or less possess the properties of China Clays and clay. I. Van Bemmelen (*Zeitschrift für Anorganische Chemie*, LXIV., 1910) decomposes these clays into two parts with hydrochloric and sulphuric acids.

(1) A silicate, A, which is soluble or, more precisely, decomposable in hydrochloric acid. The ratio of alumina to silica varies from 1 : 2·9 to 1 : 6. The proportion of water is estimated yet less precisely.

(2) A silicate, B, insoluble in hydrochloric acid and also undecomposable by this acid; but hot concentrated sulphuric acid has a reaction. The ratio is 1 : 2 or very nearly so.

Strimme and Aarnio (*Zeitschrift für Praktische Geologie*, 1911) have not contributed much to enlarge the field studied by Van Bemmelen. According to them the ratio, $Al_2O_3 : SiO_2$ varies from 1 : 1·19 to 1 : 14 in the complex substance A, and from 1 : 2 to 1 : 2·8 in B.

The results obtained by Van Bemmelen are interpreted as follows by Linck (*Geologische Rundschau IV.*, 1913).

The part soluble in hydrochloric acid.

(*a*) The ratio of the alumina and silica is greater than 1 : 2, as in kaolinite.

(*b*) It is more closely allied with chemical and physical movements, owing to its great degree of fineness, such as the absorption of water, bases, salts and acids.

(*c*) The chief bulk is, no doubt, in a colloidal state.

The part insoluble in hydrochloric acid and decomposed by sulphuric acid.

(*a*) It is usually regarded as consisting of kaolinite as analyses give a ratio, alumina-silica, of about 1 : 2.

(*b*) As the grain is finer it has dimensions more like those of the colloidal state. The ratio of the two constituents varies very much.

An important point in study of a China Clay or other clay is to have a very uniform sample because the dimensions of the grain have great influence in analysis. The China Clay is run through a sieve with 422 meshes per sq. centimetre, the residue being crushed in a mortar until it passes through the sieve without leaving any residue. The rock *débris*, argillous substance and free silica can be separated by scientific analysis.

Sulphuric acid also exerts an action on minerals such as mica, augite, hornblende, garnet, etc., as also anorthite, leucite, nepheline, and this may lead to remarkable errors. Analyses is affected by the fact that the mica and other silicas present contain alumina which is calculated in feldspar and this gives a false percentage of the latter. The microscope affords the best means of ascertaining the presence of these minerals. The general results of analysis should then be discounted, because, according to what has been said, errors originate in the undecomposed minerals. The important *rôle* played by scientific analysis is due to the fact that it has served as a basis for industrial China Clay and clays which contain very little undecomposed rock.

Method of Working

The China Clay, 2 grams, is put into a beaker (to contain 600 cubic centimetres) with 100 cubic centimetres of water. To obtain a good division a few cubic centimetres of soda lye can be added, all being then heated. When cooled, an addition of 50 cubic centimetres of sulphuric acid is made and then the mixture is heated without closing the vessel until the fumes of sulphuric acid distinctly appear. After cooling, 400 to 500 cubic centimetres of water are added and the liquid is allowed to settle before being poured on to an indurated filter. It is there well washed and the filtrate set aside. This residue contains the quartz, mica, feldspar, etc.; and the silica from the argillous substance. The last mentioned is removed with a 5 % sodium carbonate solution. There is then a residue on the filter which is treated hot (after putting it into a beaker) with 150 to 200 cubic centimetres of carbonate solution, and then allowed to rest. The quartz and feldspar remain, which are washed, calcined and weighed. Treatment of the residue with hydrochloric acid gives alumina and alkalies when there are any.

Instead of utilising raw China Clay the material has been burn to 710° C. before analysis. A fall in the speed of heating when the water separates is noted by following the phenomenon of dehydration. According to the kind of clay, this temperature at which water separates varies. Experiments on this point were made by Le Châtelier, Rieke, Sokoloff, Mellor and Holdcroft (*Sprechsaal*, 1911). Rieke found that all clays meet with a lagging in the rise of temperature above 500° C., which is particularly the case from 560° C. to 580° C. He then examined the relation of the loss of weight with the rise of temperature. Up to 450° C. the loss is slight, after which it increases to attain a maximum from 550° to 600° C.

Effect on the Solubility of Alumina

A fact which has long been known is that the calcination of a China Clay or clay has a favourable influence on solubility of alumina. Endeavours were made by Semjattschenski (*Keramische Rundschau*, 1912, No. 34) to turn this property to account to establish a method of analysis. He calcines a little of the clay on a bunsen burner at mild red heat. At first he heated it during 4 to 4½ hours, but found later that one hour suffices. The calcined clay is put into a beaker or bottle in a water bath, with a 10 % solution of hydrochloric acid, for 10 hours. All the alumina inform of kaolinite passes into solution whilst the minerals, such as quartz, feldspar, mica, hornblende, tourmaline are not dissolved. The amorphous silica is partially so. The results depend much upon calcination, according to Sokoloff, who bases this opinion upon those given in numerous analyses made at the Technological Institute of Petrograd. Duration and regularity of calcination play an important part. The work must be kept within rather narrow limits, because under or overheating causes the formation of a residue which loses the property of dissolving in diluted hydrochloric acid. Sokoloff's plan of work comprised the following points.

Determination of the proportions between loss of water and of alumina dissolved in diluted hydrochloric acid. Explanation of the importance of the structure of the four hydrosyl groups of the Kaolinite. The possibility of an unsatisfactory action of calcination on the solubility of alumina led him to make various trials in calcination, during 1, 2 and 5 hours, at temperatures of 400° to 1,000° C. Finally, he fixed the temperature for calcination at 710° C. The time of calcination was 4 hours, including that of heating. Dehydration must be complete and solubility of alumina attains a maximum.

Details of the Calcination

The clay, 1 gram, is put into a bottle of 300 cubic centimetres capacity and then 1 cubic centimetre of double-normal hydrochloric acid is added for each centigramme. It is advisable to close the bottle, during heating, with a rubber stopper, a tube one half metre long being inserted in the latter. Then the bottle is kept in the water-bath for two hours, the contents being then filtered on an indurated filter and the residue washed. This residue is then treated

with the same quantity of hydrochloric acid for four hours. These two treatments suffice, as a third would only dissolve traces. The two filtered liquids are then evaporated, acidulating them with hydrochloric acid to make the silica insoluble. The last-mentioned is then filtered with iron oxide and analysis continued in the usual manner. The residue is treated with a sodium carbonate solution and the quantity of silica removed by this operation determined. The last residue is treated with sodium carbonate and the ordinary method of analysis followed for the silicates.

The Van Bemmelen method gives a separation into two substances, one of which is soluble in hydrochloric acid and the other in sulphuric. It may be objected that solubility in hydrochloric acid is not a property of the complex substance and that many minerals are thus dissolved or decomposed, like anorthite, leucite, nepheline, zeoliths, augite, olivine. On the other hand a colloidal state, which is a chemical state, cannot be recognised by a chemical means.

Stremme and Aarnio conclude that this method is not suitable to determine the colloidal matter and must only be accepted with certain restrictions. According to the researches of Hissink (Mitteilungen für Bodenkunde, V. 1915), the best acid to employ is hydrochloric acid with a density of 1·10, which has a constant boiling point.

To form an idea of the plasticity of the clay the hygroscopic water was estimated. This water is, as a factor of the surface, the same as the plasticity. The clay was subjected to a temperature of 110° C., and then put into an exsiccator containing 100 c.c. of fresh sulphuric acid. Pressure was reduced with a mercury pump to 720 m.m. and all allowed to remain for a day. Then the exsiccator was refilled with 100 c.c. of fresh acid and left for 24 hours. This treatment is repeated until the weight is constant.

The preceding methods were applied to a series of clays and China Clays, the results demonstrating that we can admit that there is a separation of the argillous substance, as accepted by Van Bemmelen. The ratio silica : alumina is subject to variations in the part A, whilst in the part B this ratio is about 2.

The Action of Heat on Kaolins

KAOLINS and clays when extracted from the beds are usually in the form of agglomerated lumps which, after being dried, break up spontaneously when dipped into water. Baurites and schistose clays do not do so. The kaolins employed in some recent experiments were dried, ground down, and then run through the silk sieve No. 200. Two sets of samples were made with each of these impalpable powders—(1) soft paste samples, (2) samples made with a half dry powder moistened with 4 to 8 per cent. their weight of water. These samples were then compressed at pressures varying from 375 to 400 kilogrammes per sq. centimetre.

Eyzies kaolin in a soft paste was dried and kept for five hours at a temperature of 380° C. Under the influence of heat it colours slightly owing to the decomposition of the organic matter it contains. It does not dehydrate, and the volume remains unchanged; but it hardens. After this it does not scale or crumble, cold or hot, either in pure water or in water containing 10 per cent. of its weight of soda or sulphuric acid.

The sample made with this same kaolin powder, half dry and compressed under 375 kilogrammes, then heated in the same conditions as previously, does not harden sufficiently, and breaks up in cold water. When kept for five hours at about 450° C. it grows hard and no longer breaks in water. Soft eyzies kaolin pastes, the colloidal plasticity of which is 4.25, were kept at a temperature of 450° C. for five hours, then ground down finely and run through sieve 200. The sifted powder was made into a soft paste the colloidal plasticity of which fell to 1·78. The heat of 450° C. did not destroy all the colloids of this kaolin. A new sample, made with this kaolin heated once at 450° C., was left at a temperature of 500° C. for five hours, and it also hardens and is not affected by water.

This second sample was again ground down, made into a paste and heated at 500° C. There was a loss of colloidal plasticity in each operation, the phenomenon of hardening being again apparent, though in a less degree. Clays and other plastic substances act in the same way as eyzies kaolin.

These experiments were repeated a great number of times and always with the same results. Evidently the phenomenon of hardening is due to the colloidal matter which is congealed or pectised, partially, under the action of heat before the temperature of dehydration, which is usually 650° C. to 700° C. Pectising would probably be complete were heating at 400° to 500° C. prolonged for several days.

M. Le Chatelier discovered that kaolins heated at about 1,000° C. give off heat and undergo a physical transformation. At the same time there is a shrinkage and further hardening. Thus, under the influence of heat kaolins harden without dehydration or change of volume, this hardening being due to partial congealing of the colloids they contain. After dehydration, and above 700° C., there is a physical transformation and shrinkage, the kaolin continuing to harden, whilst the colloids finally disappear.

The phenomenon of pectising or congelation of colloids plays a considerable *rôle* in ceramics, especially in the terra-cotta industries.—M. BIGOT, in *Comptes Rendus*.

Increasing Demand for China Clay

An Interview with Mr. A. D. S. Stocker

IT was interesting to learn from Mr. A. D. S. Stocker, one of the principals of the firm of Grose and Stocker, of Stoke-on-Trent, who was recently on a visit to the Clayopolis, that the operations at their China Clay mines were extending in so many directions. It was after a meeting of the Associated China Clays, Ltd., that Mr. Stocker gave our representative a brief interview. Mr. Stocker was evidently gratified with the present outlook of the industry and expressed the opinion that the trade had once more turned the corner, and despite the unsettled conditions of the Continental markets the demand for their Cornish clays was increasing. There had been quite a distinct move in the home markets, particularly among the paper manufacturers and potteries, and this is taken as an index of a general improvement in other large markets of the world.

For several generations the firm of Grose and Stocker have been associated with the China Clay trade, but not until within the past few years have their energies been actively concentrated on production. Now their extensive operations together with the sales control of three mica works, Kerrow, South Carclaze and Lower Trethowal, amounts to an annual production of nearly 100,000 tons, an output which reveals a big and rapid progress. Their renowned Caudledown mine between Stenalees and Bugle has been considerably developed, a new pit has been opened up with highly satisfactory results, and the famous brand from this mine is among the finest and whitest in the country. For the present the firm are devoting their courageous and enterprising spirit upon the development of their Carvear mine. The machinery has been brought up to date by the installation of a modern gas plant, which has enabled them to increase their annual production from 8,000 to 13,000 tons. This has necessitated an increased drying capacity, and in this respect Grose and Stocker are undoubtedly adopting a wise and economic policy by the erection of a new kiln close to Par station, which they are hoping to have completed by the early part of 1924.

The clay works will be connected to the dry by a pipe line, and considerable road carriage will be avoided, and consignments, whether they are for Fowey or direct by rail to their various distributing depots, will be dispatched more expeditiously. Mr. Stocker informs us that they have several large and important schemes in contemplation, but these must remain in their embryonic stage until a much larger output is demanded. With the exception of a kiln at Carvear, the whole of their China Clay mines are linked up with the railway branches in the district. The Lausalson works have also undergone an entire revolution in its mechanical equipment. Electricity has superseded the expensive steam power with far more satisfactory results, and their output nearly doubled. Improved machinery has been laid down at the firm's East Goonbarrow mine, and some adjoining land has been acquired for a large scheme of expansion in the near future. The Bugle China Clay Co., another section of the firm's China Clay interests, has received a similar impetus under the progressive administration of Grose and Stocker. The whole of the works or mines are well staffed with supervisors of practical experience, and in their local representative, Mr. T. Martin, the firm have an official quite in harmony with the enterprising spirit of the directors.

The China Clay Industry

A Review of the Trade During the Past Ten Years

An analysis of the China Clay trade of Devon and Cornwall for the last 10½ years reveals some remarkable facts as to the incidence and fluctuations of the trade during this period. Considering the post-war figures first, it is gratifying to note that from the commencement of the revival after the slump year of 1921, the trade has shown steady progress, so much so that it has nearly reached the best post-war year of 1920. This is seen by the following figures :—1923, six months ended June, 432,246 tons, value £1,050,500, compared with the whole year 1922, 736,900 tons, value £1,903,700; and 1920, 864,360 tons, value £2,524,100.

It will be noted that for the first six months this year the total deliveries have been almost exactly half of the total for the post-war boom year of 1920, but the second half of the year has not been so good as the first half, and therefore the total for the year may not reach the total for 1920. Judging by the figures to date this year, the total will be very much better than it was last year.

Had the conditions which prevailed on the Continent last year ruled this year, the total volume of trade would undoubtedly have exceeded the total of 1920, but in consequence of the crisis with regard to reparations, and the occupation of the Ruhr, the development in the Continental trade, which was one of the features last year, has been arrested. The fact that in spite of this undoubted hindrance to the development of the China Clay overseas trade, the volume of business done has exceeded that of last year, indicates the expansion of China Clay business in other than European countries.

The following figures show what an important bearing the China Clay export trade has upon the prosperity of the industry, the ratio before the war having been approximately two-thirds export to one-third home. In 1913, which was not a normal year in consequence of a three months' strike amongst the China Clay workers, the exports were :—

	Tons.	Value £
Foreign	598,420	695,990
British Possessions	31,270	47,430
Total export	629,690	743,420
Home	275,570	326,090
Total trade	905,260	1,069,510
1914.		
Foreign	595,955	697,838
British Possessions	32,665	57,856
Total export	628,620	755,694
Home	266,612	319,934
Total trade	895,232	1,075,628
1915.		
Foreign	298,230	360,640
British Possessions	35,730	67,940
Total export	333,960	428,580
Home	262,650	337,070
Total trade	596,610	765,650
1916.		
Foreign	428,640	428,640
British Possessions	40,540	98,850
Total export	469,180	527,490
Home	231,160	314,950
Total trade	700,340	842,450
1917.		
Foreign	271,620	377,320
British Possessions	39,120	103,320
Total export	310,740	480,640
Home	185,070	286,870
Total trade	495,810	767,510
1918.	Tons.	Value £
Foreign	205,700	370,430
British Possessions	26,760	73,710
Total export	232,460	464,140
Home	221,410	440,970
Total trade	453,870	905,110
1919.		
Foreign	267,590	698,570
British Possessions	18,440	64,360
Total export	286,030	762,930
Home	231,510	615,430
Total trade	517,540	1,378,360
1920.		
Foreign	460,370	1,315,530
British Possessions	35,430	135,150
Total export	495,800	1,450,680
Home	368,560	1,073,440
Total trade	864,360	2,524,120
1921.		
Foreign	227,530	659,730
British Possessions	14,410	61,490
Total export	241,940	721,220
Home	103,310	306,060
Total trade	345,250	1,027,280
1922.		
Foreign	482,860	1,223,490
British Possessions	14,740	60,960
Total export	497,600	1,284,450
Home	239,330	619,280
Total trade	736,930	1,903,730
1923 (first six months).		
Foreign	257,370	609,470
British Possessions	11,050	43,130
Total export	268,420	652,600
Home	163,810	397,930
Total trade	432,230	1,050,530

The Best Year

The year 1912 was the best year the industry has ever experienced, when nearly one million tons were delivered, of the value of £1,052,530. The worst year was 1921, when approximately only 350,000 tons were disposed of.

One of the most remarkable features of the growth of the industry during the last ten years has been the strength of the exports to the United States. Since 1912 they have dropped below 200,000 tons in only three years; twice, in 1914 and 1920, they have exceeded 317,000 tons per annum. The best pre-war total was 252,380 tons in 1912; the best post-war year was 1922, when nearly 290,000 tons were taken. The stages of growth in the American market are shown by the following figures :—1875, 130 tons; 1880, 7,823; 1885, 10,620; 1890, 27,130; 1895, 70,585; 1909, 104,830; 1910, 231,230.

This heavy demand from America has been one of the main causes of the development of the China Clay trade to its present dimensions. In this connection the growth of the industry is shown by these figures :—1809, 1,750 tons; 1819, 2,000; 1826, 7,000; 1838, 13,500; 1862, 61,550; 1865, 97,756; 1870, 100,000; 1887, 200,000. In the 25 years that intervened between 1887 and 1912 it rose to 960,000 tons.

The countries mainly responsible for the heaviest drop in the export markets since before the war have been Russia and Germany, which in 1912 took over 140,000 tons between them—Germany over 90,000, and Russia over 40,000 tons. Since the war these two countries have not taken more than 15,000 tons between them in any one year, the Germans' best year having been 1922 with 11,840 tons, and Russia's best,

1920, with 4,830 tons. Of the European countries, Belgium and Scandinavian countries have shown the best recovery approximating to the pre-war figures. France and Italy have been slower.

Evidence of the expansion of trade in Spain is seen in the fact that last year Spain took over 11,000 tons, and for the six months ended June this year that country has taken more than half of that quantity. It is encouraging to note that for the first time since the war, Austria and Hungary figure in this year's export list. The interesting question as to what our China Clay is used for by new and remote customers, is raised by the appearance of such countries as Mexico, Peru, Uruguay, Siam, Turkey, Morocco, Greece, etc.

New Countries Trying China Clay

Indications are forthcoming that new countries are trying our China Clay, if only in small quantities, and it would be well to try to develop such new markets, Australia, Egypt, Ceylon, South Africa and the West Indies being examples.

So far as can be gathered, the opening of demand for China Clay from these distant countries marks the beginning of new markets, and is not in substitution of markets elsewhere.

The prices at which China Clay has been sold for the past ten years, have, as might be expected, fluctuated very considerably, but it should be a source of satisfaction to buyers to know that the ratio of the increase to the prices ruling at present are below what are warranted, bearing in mind the increased cost of production to-day compared with pre-war. Striking an average per ton of the total volume of clay sold, whether for home or overseas destinations, the following figures emerge :—1913, £1 3s. 6d. per ton ; 1914, £1 4s. ; 1915, £1 5s. 9d. ; 1916, £1 4s. ; 1917, £1 11s. ; 1918, £1 19s. 9d. ; 1919, £2 13s. 3d. ; 1920, £2 18s. 6d. ; 1921, £2 19s. ; 1922, £2 11s. 8d. ; 1923, £2 8s. 6d.

These averages are based on the free on board prices. It will be noted that they reached their highest level in 1921, which was a slump year, when the establishment charges were the same on a very much lower tonnage than in the year previous, which was the post-war " boom " year. Prices of China Clay have always to be fixed with an eye to the increasing competition of clays of other countries, but, generally speaking, in normal times the home product is in a most favourable position for competing, in consequence of China Clay being mined adjacent to the seaboard, and the biggest markets for it being also similarly situated, whereby the transport by water is always available.

Cornwall Produces Nine-Tenths of the Total

The China Clay industry in this country is confined to Cornwall and Devon, but Devon's production is small compared with that of Cornwall, the proportion being approximately Cornwall nine-tenths and Devon one-tenth of the total output.

The term China Clay applied to official returns of deliveries whether home or foreign, embraces mica clay (a cheaper grade of China Clay derived from the residue of China Clay), and china stone, the raising of which is limited to Cornwall. The output of china stone constitutes the smallest volume of these three products, which is shown by the figures of 1920, when out of a total of 864,370 tons, a little over 73,000 tons was china stone.

The figures and analyses of them given in this article should prove of considerable interest to our readers, in enabling them to arrive at accurate conclusions as to the strength or weakness of some of their old markets, and as to new markets which provide scope for development.

Is this a Record ?

Mr. Kitchen, of Simpson, Spence and Young, shipbrokers, told us that for 25 years he had only missed being at his office twice through illness, and was always there at 9 o'clock sharp. We know Mr. Kitchen is interested in obtaining record China Clay shipments, but he has surely made a record for time-keeping which puts most of us to shame. He attributes his good health largely to his love of walking, and still enjoys a 20 to 25-mile tramp in the country, when he can find time for it. May he live to enjoy many more of them.

Devonshire Ball Clay

An Outline of the Industry

The ball clay industry of Devon is still somewhat an unsolved mystery to those in the China Clay districts of Cornwall, and although situated so near to many of the China Clay pits, many in the district have never yet seen the ball clay works.

The ball clay is a most interesting raw material and particularly so if one is something of a geologist. It serves much the same purpose in manufacture of plates and cups as alloy does in a coin, and is sent to Staffordshire and exported to various parts of the world where potteries are to be found. This is the clay which is mixed with China Clay and other ingredients to make dinner services, etc., and is used as a " stiffener." There is another inferior sort of ball clay which is used more or less by itself, and which is known as " stoneware clay," and goes into the manufacture of jam jars, hot water bottles, ginger beer bottles, etc., and there is still another sort of ball clay produced in Devonshire known as " cutty clay." This quality of clay is used in the making of white clay smoking pipes, etc. A still cheaper, inferior sort of clay is the " drain clay " and after that comes a broken clay called " brokes " by the clay workers themselves. This clay is similar to the " stoneware " and " drain " brand with a large percentage of fine sand in it, and because of the presence of sand, and consequently the lack of plasticity which is obtained in less sandy clays, it would not " stand ball " hence the term " brokes."

A Visit to a Ball Clay Pit

The particular ball clay pit which we visited—30 ft. below the surface of the ground—the clay diggers were making the " floor " of the pit which looked very much like a chess board. With a heavy chisel-like tool attached to the end of a long handle the clay is cut straight across the pit one way, the incisions being, perhaps, 12 in. deep and some distance apart, and a similar cut is made across the other side forming a series of squares on the whole floor of the pit. Another digger then follows this operation with another sort of tool and separates the lower side of the ball from the clay beneath which soon becomes another floor. These " balls " are then shovelled to one side, when one of the men, who has had many years' experience, separates them, one by one, some being put into the tram wagon, which was let down to the pit on an incline from a main line, and run up to the loading station on the surface.

All these " balls " appear to be identical and of much the same quality, and it is only an experienced worker who can tell the difference. In our visit to this pit we saw the digger separate the " balls " or " squares " of clay, each one existing as neighbours and apparently exactly alike. This selector, from years of experience, knew exactly which was the " best blue," or " second ball clay," or again that which was known locally as " yellows."

The " best blue " was to be loaded in a chartered boat going to Valencia to be made into dainty china tea cups or beautiful white floor tiles. The second quality was a less excellent grade of clay, and the third quality may have been slightly yellow for a square inch or two on its surface, and this would have found its way into the manufacture of sanitary drain pipes. It appears to be largely a question of the degree of sand in the clay which makes the quality. It is wonderful how expert the selector becomes, and if a " ball " was not well up to standard it immediately went into the next grade. They are able to tell at a glance the quality they are handling.

A Railway to Open-Up the District

The new North Devon and Cornwall Junction Railway is eventually placing this section of North Devon on the map, and will be a great boon to the ball clay industry. It appears that of the earthing work in connection with the railway only about 20 per cent. remains to be done. The biggest of these cuttings is at Meeth, which is at the centre of the line. The largest item, Torrington Viaduct, is practically completed, and construction and ballast trains can now run over it. The contractors have carried out this work, which is by no means easy, with almost no inconvenience to the public traffic, which has never been held up for one moment. The laying of the permanent way has already been commenced.

The Manufacture of Portland Cement from Marl

By Raymond E. Kirk

The notes given below are abstracted from a report on an official investigation carried out by Mr. R. E. Kirk for the University of Minnesota, U.S.A., and contain many valuable facts concerning the manufacture of Portland cement from marl instead of the more usual limestone.

THE Portland cement industry has developed so rapidly that the importance of Portland cement in our modern civilisation has not been generally appreciated. There is every reason to believe that there will be a continued growth of this industry. New uses, especially in road making, are being discovered for Portland cement and, with added knowledge of the proper methods of concrete construction, its known uses are growing in favour. The increase in building expected in the next few years will call for increased amounts of cement, and road development means the use of more and more cement.

Many of the first Portland cement plants established used marl and either clay or shale as their raw materials. Just as good Portland cement can be made from marl as from any other calcarceous material. The utilisation of marl is then to be considered as a question of technology and of economic advantage.

Marl is an unconsolidated carbonate of lime deposited in the beds of present or extinct lakes in glaciated regions. The marl comes from the leaching out of carbonate of lime from the surrounding soil by the combined action of water and carbon dioxide. The water then contains lime bicarbonate, $Ca(HCO_3)_2$, giving to water the property usually known as temporary hardness. This is then deposited again as marl in favourable parts of the lake.

Marl and Clay

Perhaps more cement plants have failed because of a low grade or inadequate supply of raw materials than for any other reason. A very thorough and systematic investigation of the deposits of both marl and clay should precede any plans for building a plant. Marl must carry a relatively high percentage of calcium carbonate. The higher this percentage the more desirable does the marl become. Above 90 per cent. dry basis is desirable, though plants have operated on marl with a calcium carbonate content of as low as 80 per cent. The lowest limit that can be used will depend on the character ot the impurities present. The amount of magnesium carbonate should be low. More than 3 to 4 per cent. would be undesirable, especially if the clay or shale to be used carried some magnesia. Very few marls, however, carry large amounts of magnesium carbonate, even in regions where the surrounding limestones are highly dolomitic. This fact is doubtless due to the effect on the deposition of the marl of the varying solubilities of the carbonates of calcium and magnesium.

The amount of organic matter present in the marl is of vital importance. When organic matter is present the amount of water needed to give a slurry that can be handled by the machinery of the plant is greatly increased. As a consequence, the kiln capacity is reduced and the fuel cost raised. The amount of water needed to form a workable slurry will vary greatly with different marls with about the same content of organic matter. It seems that the character and state of division of the organic matter is of as great importance as the amount. It also seems probable that the physical condition of the marl itself is a factor in the amount of water needed in the slurry. In practice some plants have been able to operate quite effectively with amounts of organic matter over 5 per cent. Other plants find difficulty in operating with more than 3 per cent. organic matter.

The presence of sand in marl is usually considered very disadvantageous. Plant practice varies as to the amount of sand that can be utilised. Some plants encounter difficulty merely because they do not vary the other ingredients of the mix to get the proper chemical relationship. In general, it may be said that the main body of a marl desposit should contain less than 2 per cent. of sand. Amounts of sand up to 5 per cent. can be tolerated in small areas of the deposit. Their utilisation will require careful management on the part of the plant chemist.

Many marl beds have pockets of clay and in some cases rest on a layer of clay. If this clay is of the proper character for use in cement-making, its presence is an advantage. The amount of clay added at the mill must be altered as required. The clay may, however, be high in magnesium carbonate and so be disadvantageous. The amount of alkali present should be small. The cost of excavating and transporting the marl should be relatively low. No blasting is necessary in excavating marl. Not many men are required, and the maintenance cost is low as compared with quarry operations. This represents one decided advantage of marl over limestone as a raw material.

Mixing and Grinding of Raw Materials

The marl comes to the mill in a form that requires no preliminary grinding before mixing. It may require screening to remove stones and twigs. When clay is used it may be crushed through rolls and then mixed with water in a "wash mill." A more usual practice at plants using marl is to grind up the clay in a mill of the type in which the material is crushed in a pan under a pair of heavy rolls, the rolls having two motions, rotating on a horizontal axis and revolving as a whole about a fixed vertical axis.

In wet process plants using limestone the wash mill or wet pan method of handling the clay has some advantages, but for plants using marl dry grinding of the clay is advantageous, since the water content of the marl-clay mixture is more readily kept within the desired limit when the clay can be added in the dry condition. The marl and clay or shale are mixed in the determined proportions in a tank. Here the materials are thoroughly intermixed by mechanical agitation. The mixture is then passed to the grinding equipment. This is of the ball grinding type. The grinding of these soft, wet materials is relatively easy and the costs are relatively low. This represents another decided advantage in the use of marl.

The one point to be most carefully watched in the mixing and grinding department of a cement plant using marl is the water content of the slurry, as it goes to the kiln. The equipment and operations should all be those designed to produce a slurry of as low a water content as possible. Under no circumstances should it go much above 50 per cent. as fuel costs in the kiln increase rapidly as the water content mounts. Because of the physical character of marl it is impossible to produce slurries therefrom with the low water content that is found in wet process plants using limestone.

The slurry after final grinding is sent to one of a series of storage basins. As each tank is filled a sample is taken and subjected to chemical analysis. If the proper proportion of ingredients is not present the slurry may be corrected by adding the required amount of marl or clay. More often, however, the slurry is corrected by mixing the tank of material low in one ingredient with another tank high in that same ingredient. This mixing is carried out in a mixing basin of about twice the capacity of the slurry tanks. Evidently this system of handling the material going to the kilns gives an opportunity for very exact chemical control. Consequently the finished cement is very uniform in character.

Burning the Clinker

The slurry is calcined in the usual rotary kiln. The practice in burning is essentially the same whether the raw calcareous material be marl or limestone. From the figures given for water content it is evident that the production of cement from a given kiln will be less with a marl than with a limestone slurry. Evidently, too, the same kiln, using the dry process, will have an even larger production. The fuel cost per barrel of cement will also be less with the slurry of low water content and even less with the use of the dry process. This difference is much less with long than with short kilns.

The general tendency in cement technology has been towards the use of longer and longer kilns. At the present time very few new plants are equipped with kilns less than 150 ft. long. Many kilns of 175 to 200 ft. in length are in use, and some kilns 240 and 250 ft. in length are in operation. The longer kilns have given reduced fuel costs and have shown decided decreases in stack temperatures. Especially with the wet process has the use of long kilns introduced greater efficiencies. Many of the marl-using plants built with the short kilns of twenty years ago have found it impossible to continue operations with such antiquated equipment.

The most recent development in the Portland cement industry has been the successful introduction of waste heat boilers. These utilise the heat of the gases leaving the kilns which would otherwise be lost. This developement, while of theoretical interest for many years, has been forced upon the manufacturer by the great increases in the cost of fuel during the war and the post-war periods. The results obtained in practice are such as to render it evident that any new installation should include waste heat boilers in order to meet the competition of other plants. Many old plants are installing waste heat equipment and it seems that the extraordinarily long kilns being installed by some companies could be better replaced by somewhat shorter kilns equipped with waste heat boilers. Many plants find that waste heat boilers furnish all the power needed. Some plants even have a surplus of power to be disposed of outside of their own establishments.

Fuel

The usual fuel is powdered coal. The proposal has also been made to utilise the producer-gas from a peat fired producer-gas furnace to burn the clinker. The fuel consumption is related directly to the length of the kilns, the stack temperatures, and the amount of water in the slurry. The quality of the coal is also a factor worthy of note. Most plants in the U.S.A. use a good West Virginian soft coal with not to exceed 10 per cent. ash. Where the kilns are long enough that the slack temperatures may be kept between 700° and 800° F., a marl slurry of about 50 per cent. water will require from 125 to 150 lb. of such coal for each barrel of cement. The use of waste heat boilers will enable the recovery of at least enough energy from the stack gases to furnish the power for the other operations of the plant.

Wet Process and Dry Process

Since the use of marl in the manutacture of Portland cement necessitates the adoption of the wet process (called semi-wet in Europe), a comparison of the two processes would seem of value. The wet process involves the mixing and grinding of the materials in the presence of water. The resultant slurry is then introduced into the kilns. This process is always used for marl and may be used for hard limestone and cement rock. It has even been used with blast furnace slag. The dry process involves the mixing and grinding of the raw materials in as dry a condition as possible. The resultant mixture is introduced into the kilns dry. This process has been widely used for limestone and cement rock. Nearly all blast furnace slag used for making cement is handled by this process.

The advantages of the dry process may be enumerated as follows: (1) less fuel used per barrel of cement—no water to be driven off in the kiln. There is not such a decided advantage in this respect with kilns of 200 ft. in length and longer. (2) Decreased overhead cost per barrel of cement—due to the larger amount of cement burned in the kilns each 24 hours; (3) dry materials may be ground exceedingly fine—thus insuring intimate mixing of materials and complete reaction in the kilns of all the particles.

The advantages of the wet process are as follows: (1) complete chemical control of the character of the mix—thus giving a more uniform product. Correction of the mix may be made before burning; (2) lower "stack" temperatures—around 800° F. being usual practice in wet process plants as compared with around 1,500° F. in dry process plants. This tends to offset the increased amounts of fuel needed to drive off the water; (3) lower costs of grinding of raw materials; (4) more intimate mixing of raw materials without the need for such fine grinding; (5) waste heat boilers can be used to great advantage.

It is worthy of note that the majority of the plants built within the last few years have adopted the wet process. While it is impossible to predict accurately the future technical development of the Portland cement industry, it would seem that in the future wet process plants where properly designed and constructed, and especially when equipped with waste heat boilers, will be able to compete on at least even terms with dry process plants. An advantage will accrue to the wet proceess plants using limestone as compared with those using marl because of the smaller amount of water needed to make a workable limestone slurry. Only from 30 to 40 per cent. water is needed for limestone, while marl slurries are seldom below 47 per cent. This will be offset, in part at least, by the decreased grinding cost with marl and by the small cost of excavating the marl.

Plant Management and Operation

Experienced and competent engineers and chemists will be needed in a plant using marl even more than in one where the practice is more standardised. A large measure of energy and initiative must be added to their knowledge. On the judgment and discretion of the staff will depend in large measure the success or failure of the plant. They must beware of impractical ideas and yet be open-minded to any possible improvements in operation. The operating officials of the plant should be responsible to the company only for results. In matters of plant operation and control they should be given a free hand.

There is in existence at the present time no plant with complete modern equipment designed to use marl. As a consequence a plant intended to use marl must be designed by adapting certain features developed in the industry where other raw materials are in use. Some rearrangement and remodelling must be anticipated before such a plant can operate to its greatest efficiency. The general plan of the plant should be such that the materials would pass in an orderly progression from raw materials storage to finished materials storage. Mechanical transportation of all materials is essential. A bulky product like Portland cement can only be economically produced by utilising to the utmost mechanical labour-saving devices. Electrical operation of machinery is recommended.

Summary

To summarise briefly, it would seem that the following conditions are essential to the successful operation of a Portland cement plant using marl and clay or shale:—

An adequate supply of marl and of clay must be known to be available. It has been estimated that 320 acres of marl 20 ft. deep would be needed to supply a 2,000-barrel mill for thirty years. Other marl beds near by would be desirable. The quality of the marl must be high. Careful investigation should be made as to the character of the marl by competent analysts. The plant should be designed by competent engineers, and controlled and operated by experienced engineers and chemists. Modern equipment should be used—long kilns and waste heat boilers should be installed. The machinery and methods of handling the raw materials must be such as to keep the water content of the slurry below 50 per cent. The plant must be advantageously located with respect to a market for its product, and with respect to shipping facilities. Freight rates determine quite largely the location of cement plants. The plant should be located in a territory where there is no limestone suitable for use in the making of Portland cement.

In a territory where a quality of limestone suitable for use in cement is available it would not be wise to attempt operations using marl. The theory and practice of modern cement making have been almost entirely developed in plants using limestone. The design and operation of such a plant would not present the difficulties that should be expected in a plant designed to use marl. As previously pointed out, a company considering the use of marl must expect to pass through a period of experimental development and must provide funds for a possible partial change in process or equipment. Where a supply of suitable limestone is lacking, the character and amount of the marl deposits should be carefully investigated. Under the conditions enumerated in the preceding paragraphs a Portland cement plant using marl should be a technical and financial success.

China Clay Notes and News

China Clay Research

An announcement that will be received with great satisfaction throughout the China Clay industry was made by Mr. W. Rose, of Messrs. North and Rose, and a Director of Associated China Clays, Ltd., at St. Austell Rotary Club luncheon recently, with reference to China Clay research work to be undertaken by the South Western University at Exeter. Mr. James Perry, of the Burthy China Clay Company, also a Director of Associated China Clays, Ltd., presided. Mr. Rose said he was a member of the Cornwall Education Committee who recently voted £500 to Exeter University, of the new governing body of which he was a member. At a recent meeting of the Governors of that institution, he said, he welcomed a statement by the President, Sir Henry Lopes, that it was the desire of the University to do more in the way of research work, and suggested to the Governors that they might extend the usefulness of the University by undertaking research work in China Clay. He reminded them that in spite of financial distress, Cornwall had voted £500 for the second time for the promotion of the work of the University, and there was no better way of appreciating that than by the University authorities devoting some time and money to China Clay research work.

Future Possibilities

Mr. Rose confessed that China Clay producers did not thoroughly understand China Clay and its capabilities. Since Cookworthy discovered it as a substitute for Chinese kaolin, in the manufacture of porcelain, other uses had been found for it, so that now not more than 20 per cent. of China Clay was used for potting. With proper research he thought that discovery of new uses could be made, just as its completely successful use in paper-making had been discovered, a discovery which marked the real beginning of the growth of the industry to its present dimensions. It was necessary that they should better understand the material that they were dealing with in order to meet the needs of manufacture. They thought they had reached the limits of refinement of China Clay, but recently they had been producing by electrical processes China Clay possessing colloidal qualities which had to be sold at a very high price owing to the cost of producing it. One of the things that they would like to find out was how to produce clay of this exceedingly fine quality so that they could charge their customers less money for it, for the cheaper they could sell it the larger would be the use of it.

Chemistry Experts to Visit China Clay Works

Mr. Rose added that the University authorities were so taken with his suggestions, that the principal, Professor Hetherington, undertook that the University would give practical effect to them by arranging for the head of their chemistry and research work department (Professor Lewis) and a member of his staff to study the China Clay industry on the spot, and make investigations with a view to research work on the lines Mr. Rose had sketched, while the China Clay producers would render all the facilities they could to assist the University officials in their work. Mr. Rose concluded by saying that he believed the University would be able to put them in the way of doing things better than they were now doing them by their more or less crude methods.

The Chairman expressed the delight of the Rotarians for Mr. Rose's welcome announcement, and endorsed his views on the value of research work in the China Clay industry, for which they had been waiting for a very long time. He was sure the China Clay producers through their association would be glad to render the University all the assistance they could.

St. Austell Bank Official's Promotion

For fifteen years cashier, first at the Capital and Counties Bank and, since the amalgamation, at Lloyd's Bank, at St. Austell, Mr. Arthur Hugh has been promoted to the position of manager of Lloyd's Bank at Penryn. Mr. Hugh had wide knowledge of China Clay finance through his association with the accounts of many China Clay firms doing business with his bank. He had won the esteem of many China Clay producers by his ability and manner, who have paid tribute to his capacity for the post that he has deservedly secured. Mr. Hugh joined up as a private during the war and served in Italy.

China Clay Company's New Road

It frequently happens in the China Clay district that, in consequence of the working of the pit, public roads have to be diverted. Such a case has recently occurred on the North Goonbarrow China Clay Co.'s sett at Hensbarrow, near St. Austell, where the company have just completed a fine new road. Sir Arthur Carkeek (chairman of the County Council Highways Committee) opened the new road, which has been created by the diversion of the county main road by the North Goonbarrow China Clay Co. in order to develop their works, and which was carried through during the past nine months to provide work for a large number of men who otherwise would have remained unemployed.

Declaring the road open to the public, Sir Arthur congratulated the company on carrying out a project which he considered a great benefit to the county, inasmuch as the new road was 30 ft. wide, against the old road's average of 18 ft. The new road had no dangerous corners, as was the case with the old road, and not such a steep gradient.

Sir Arthur considered the handing over of a road of this width to the county in such fine condition was a valuable piece of work.

The whole cost, between £6,000 and £7,000, had been borne by the North Goonbarrow China Clay Co., without any grant being made in respect of the work, which had given relief to the unemployed.

Messrs. J. W. Higman and J. Lovering (Justices of the Peace), who have carefully watched the construction of the road, and were present in their official capacity to certify that the work had been carried out satisfactorily; F. W. Jenkin, a member of the County Council; and Mr. F. H. Smith (clerk to the St. Austell Rural District Council) also congratulated the company on their fine achievement, and Mr. Hart Nicholls, managing director of the company, expressed the thanks of the company to those who had attended that day.

Letter Received

"Please send us a copy of THE CHINA CLAY TRADE REVIEW, for which we enclose 6d., as we have just opened a china shop here." This is one of a number of similar letters received from writers who evidently want a pottery journal, but it only goes to show how little the general public knows of China Clay.

Detection of Mineral Matter in Paper

THE mineral substances commonly found incorporated in paper are China Clay, pearl hardening (calcium sulphate), and agalite (talc). In addition to these may be present alum from the sizing materials, and in coated papers blanc fixe (barium sulphate) and satin white (calcium sulphate with alumina), states H. A. Bromley in *Paper and its Constituents*. All these bodies being incombustible are found in the ash upon incineration of a paper containing them, and their separation and identification may present some difficulty.

Satin white and pearl hardening are entirely soluble in warm dilute hydrochloric acid without change. Their presence may, therefore, be confirmed by the addition of barium chloride to the solution, which will occasion a white precipitate of barium sulphate if they are present.

China Clay is insoluble in hydrochloric acid. It is soluble in boiling sulphuric acid, but is best detected by treatment with fusion mixture, by which the alumina is converted into carbonate and the silicate into soluble silicate, enabling the two substances to be separated and identified.

Blanc fixe is also insoluble in acids, and is detected, as with China Clay, by fusion, barium carbonate and sodium sulphate being formed.

Agalite in like manner is converted into magnesium carbonate and sodium silicate.

The presence definitely confirmed in this way of calcium and a sulphate indicate the presence of pearl hardening in the original paper. In the same way, calcium, alumina, and a sulphite indicate satin white; and alumina and silica-china clay.

Shipping and Export News of the Month

We give below the latest particulars relating to arrivals and sailings of ships engaged in the China Clay Trade, at the principal British clay ports. Registered exports of China Clay with countries of destination, and other shipping and export matters are dealt with.

Shipping—Fowey, October, 1923

Arrived.	Name.	Sailed.	For.
Oct. 1, s.s.	*Waterway*	Oct 6,	Brussels
Oct. 1, s.s.	*Tymeric*	Oct. 13,	Portland Me.
Oct. 2, s.s.	*Iron Duke*	Oct. 6,	Avonmouth
Oct. 2, s.s.	*Hebe*	*	
Oct. 3, s.s.	*Helena Anna*	Oct. 15,	Runcorn
Oct. 3, s.s.	*Isolda*	Oct. 20,	Gothenburg
Oct. 3, m.v.	*Earl Cairns*	Oct. 8,	Par
Oct. 3, s.s.	*Mersey*	Oct. 5,	Preston
Oct. 3, s.s.	*Lilla*	Oct. 16,	Swansea
Oct. 4, s.s.	*Pansy*	Oct. 6,	Preston
Oct. 4, s.s.	*N. P. Petersen*	Oct. 13,	Munkedal
Oct. 4, s.s.	*Briar Rose*	Oct 5,	Preston
Oct. 5, s.s.	*Wekkika*	Oct. 10,	New York
Oct. 5, s.s.	*Greta*	Oct. 9,	Gothenburg
Oct. 5, m.v.	*Jupiter*	Oct. 9,	Stockholm
Oct. 6, s.s.	*Rosabelle*	Oct. 8,	Garston
Oct. 6,	*Raymond*	Oct. 31,	Newcastle
Oct. 9, s.s.	*Seaforth*	Oct. 12,	Weston Point
Oct. 10, s.s.	*Nigretia*	Oct. 13,	Antwerp
Oct. 10, s.s.	*Ciscar*	Oct. 17,	Genoa
Oct. 10, s.s.	*Galathea*	Nov. 2,	Morocco
Oct. 11, s.s.	*Olive Branch*	Nov. 1,	Runcorn
Oct. 12, s.s.	*Kentish Coast*	Oct. 16,	Swansea
Oct. 13, m.v.	*Borge II*	Oct. 17,	Methil
Oct. 13, s.s.	*Vechstroom*	Oct. 17,	Amsterdam
Oct. 13, s.s.	*Ary*	Oct. 22,	Portland Me.
Oct. 13, s.s.	*Farfield*	Oct. 17,	Manchester
Oct. 15,	*Amanda*	Oct. 31,	Weston Point
Oct. 15,	*Flora*	Nov. 7,	Par
Oct. 16, s.s.	*Reedness*	Oct. 18,	Gravesend
Oct. 16, s.s.	*Blush Rose*	Oct. 18,	Weston Point
Oct. 16, s.s.	*Falmouth Castle*	Oct. 18,	Weston Point
Oct. 16, m.v.	*Lydia Cardell*	Oct. 31,	Grimsby
Oct. 16, s.s.	*Mayrix*	Oct. 20,	Antwerp
Oct. 16, m.v.	*Harjumaa*	Oct. 20,	Norrkoping
Oct. 16, s.s.	*Homedale*	Oct. 20,	Antwerp
Oct. 17, m.v.	*Intrepido*	Oct. 31,	Genoa
Oct. 17, s.s.	*Adam Smith*	Oct. 20,	Liverpool
Oct. 17, s.s.	*Edern*	Oct. 20,	Aberdeen
Oct. 17, s.s.	*Condor*	Oct. 22,	Antwerp
Oct. 17, s.s.	*Multistone*	Oct. 23,	Tayport
Oct. 18, s.s.	*Primrose*	Oct. 23,	Preston
Oct. 18, s.s.	*Moss Rose*	Oct. 23,	Fleetwood
Oct. 18, m.v.	*Wigala*	Oct. 26,	Sarpsborg
Oct. 19, m.v.	*Mary Millar*	Oct. 31,	Ardrossan
Oct. 19, s.s.	*Elswick House*	Oct. 28,	Philadelphia
Oct. 24, s.s.	*Guelder Rose*	Oct. 26,	Preston
Oct. 26, s.s.	*Jacinth*	Oct. 28,	Dunkirk
Oct. 26, s.s.	*Turnus*	Oct. 31,	Oscarshamn
Oct. 28, s.s.	*Mersey*	Oct. 31,	Hull
Oct. 28, s.s.	*Nephrite*	Oct. 31,	Bo'ness
Oct. 29, s.s.	*Hayle*	Nov. 1,	Weston Point
Oct. 29, s.s.	*Ualan*	Nov. 5,	Brussels
Oct. 29, s.s.	*Trader*	Oct. 31,	Sunderland
Oct. 29, s.s.	*Waterway*	Nov. 2,	Brussels
Oct. 29, s.s.	*Briar Rose*	Nov. 3,	Larne
Oct. 30, s.s.	*Pansy*	Nov. 2,	Preston
Oct 31, s.s.	*Freighter*	Nov. 2,	London
Oct. 31,	*Ingrid*	*	
Oct. 31, s.s.	*Falmouth Castle*	Nov. 3,	Runcorn
Oct. 31, m.v.	*Agnes*	Nov. 6,	Kotka
Oct. 31, m.v.	*Vildanden*	Nov. 6,	Skien
Oct. 31, s.s.	*Aaland*	Nov. 7,	Pasages & Bilbao

* Signifies in Port.

Par Harbour Shipping—October, 1923

Arrivals

Date.	Vessel.	From
Oct. 1.....	s.v. *Shortest Day*	Plymouth
Oct. 5.....	m.s. *Garthavon*	Falmouth
Oct. 7.....	m.v. *Snowflake*	Runcorn
Oct. 8.....	m.v. *Earl Cairns*	Runcorn
Oct. 12.....	s.s. *Robrix*	Hull
Oct. 16.....	m.v. *J.N.R.*	Plymouth
Oct. 16.....	s.v. *Rosina*	Plymouth
Oct. 16.....	s.v. *Britisher*	Plymouth
Oct. 17.....	s.s. *Catherina*	Falmouth
Oct. 19.....	s.s. *Goliath*	Fowey
Oct. 20.....	s.v. *Hosianna*	Falmouth
Oct. 29.....	s.s. *Treleigh*	Portreath
Oct. 29.....	m.v. *Katie*	London
Oct. 29.....	s.v. *Katherina*	Chichester

Sailings

Date.	Vessel.	Destination
Oct. 2.....	s.s. *Tanny*	Penarth
Oct. 6.....	s.v. *Shortest Day*	Pentewan
Oct. 8.....	m.s. *Garthavon*	Runcorn
Oct. 13.....	m.v. *Earl Cairns*	Charlestown
Oct. 13.....	s.s. *Robrix*	Teignmouth
Oct. 14.....	s.v. *Englishman*	London
Oct. 16.....	s.v. *Snowflake*	Runcorn
Oct. 17.....	s.v. *J.N.R.*	Pentewan
Oct. 17.....	s.s. *Catherina*	Plymouth
Oct. 20.....	s.s. *Goliath*	Fowey
Oct. 28.....	s.s. *Treleigh*	Preston

Charlestown Shipping—October, 1923

Arrivals

Date.	Name of Vessel.	From
Oct. 1.....	*Camille*	Nantes
Oct. 2.....	*Lady Daphne*	Rochester
Oct. 6.....	*Madeleine*	Cardiff
Oct. 8.....	*Adelaide*	Irvine
Oct. 13.....	*Catheirse*	Truro
Oct. 13.....	*Earl Cairns*	Par
Oct. 17.....	*Mary Barrow*	Cardiff
Oct. 19.....	*La Devon*	Truro

Sailings

Date.	Name of Vessel.	Destination.
Oct. 6.....	*Camille*	Nantes
Oct. 14.....	*Madeleine*	Nantes
Oct. 14.....	*Lady Daphne*	Rochester
Oct. 15.....	*Catheirse*	London
Oct. 16.....	*Earl Cairns*	Manchester
Oct. 25.....	*Adelaide*	Rochester
Oct. 25.....	*La Devon*	Antwerp
Oct. 31.....	*Mary Barrow*	Rochester

China Clay Exports

RETURN showing the exports of China Clay (including Cornish or China Stone), the produce of the United Kingdom, to each country of destination as registered during the month ended October 31st, 1923.

Country of Destination.	Quantity. Tons.	Value. £
Finland	1,306	1,951
Sweden	3,188	7,218
Norway	782	1,255
Denmark (including Faröe Islands)	3	24
Germany	540	1,455
Netherlands	1,686	3,984
Belgium	4,082	8,291
France	1,585	3,957
Portugal	4	16
Spain	4	20
Italy	1,954	5,697
Greece	5	50
Egypt	50	188
China (exclusive of Hong Kong, Macao and leased territories)	26	160
United States of America	19,733	44,313
Mexico	109	434
Peru	25	100
Chile	10	22
Brazil	55	289
Argentine Republic	11	83
British Possessions.		
Irish Free State	8	17
Other Ports	1,685	6,736
Madras	80	320
Bengal, Assam Bihar and Orissa	56	224
Victoria	38	158
New South Wales	10	83
Queensland	1	21
New Zealand	—	1
Fiji Island	—	3
Canada	4,676	11,791
Hong Kong	—	2
Total	41,712	98,863

October China Clay Deliveries

THERE was an increase of nearly 7,000 tons in the deliveries of China Clay through Fowey as compared with September. There was also a slight increase in total deliveries, although compared with the corresponding period last year there was a decrease of 9,000 tons through the ports but an increase of 2,500 tons by rail. The rail deliveries for October also show an increase of some 1,700 tons over September. The following are the details.

Port.	Tonnage.
Falmouth	—
Fowey	54,885
St. Blazey	492
Par	906
Plymouth	118
Cattewater Harbour	1,034
	57,614
Corresponding period last year	66,871
Decrease	9,257

Inland traffic borne by rail throughout.

	Tonnage.
This year (October)	6,845
Last year (October)	4,352
Increase	2,493
Total tonnage to all parts	64,469

Antwerp Arrivals for October

We give below particulars of arrivals of China Clay in the port of Antwerp during the month of October :—

From :				
Par	sch.	*Weser*	293 tons	Oct. 1
Fowey	m.s.	*Margareth Hobley*	190 tons	Oct. 1
Fremington	s.s.	*Orenie*	555 tons	Oct. 2
Poole	s.s.	*Alberta*	370 tons	Oct. 2
Bideford	m.s.	*River Deben*	250 tons	Oct. 4
Teignmouth	slp.	*Alexandra*	172 tons	Oct. 8
Poole	m.s.	*Henford*	300 tons	Oct. 10
Fowey	s.s.	*Nigretia*	614 tons	Oct. 15
Fremington	s.s.	*Orleigh*	560 tons	Oct. 15
Poole	ktch.	*Henriatta*	125 tons	Oct. 16
Poole	bge.	*Dominion*	180 tons	Oct. 16
Tynemouth	s.s.	*Marnix*	600 tons	Oct. 18
Plymouth	s.s.	*Alberta*	390 tons	Oct. 20
Teignmouth	s.s.	*Ivobrix*	304 tons	Oct. 21
Fowey	s.s.	*Mayrix*	944 tons	Oct. 22
Fowey	s.s.	*Homedale*	240 tons	Oct. 22
			340 tons (Tiles)	
Fowey	s.s.	*Condor*	450 tons	Oct. 25

Fowey's Interest in China Clay

Speeches at the Mayor's Luncheon

FOLLOWING the election of Alderman Frederick E. Knight as Mayor of Fowey, and of Messrs. W. H. L. Shadwell and J. G. Lewarne as Aldermen on November 9, the Mayor entertained the Aldermen and Council to a luncheon at the Fowey Hotel.

In proposing the toast, "Prosperity to Fowey," Mr. Simeon Rowe, ex-Mayor, paid a tribute to what the G.W.R. had done for Fowey in improving transport facilities. As a distributing centre for the dispatch of China Clay to all parts of the world, the provision of adequate shipping facilities was essential to its prosperity. There were prospects that greatly increased trade would be done when the countries of Europe came to their senses. As an instance of how they were suffering through the present conditions prevailing on the Continent, Mr. Rowe referred to the case of Russia, who had taken little, if any, clay in recent years.

Welcome News for Big Ships

Responding to the toast, Alderman R. Vincent made the interesting announcement that the Harbour Commissioners had amalgamated operations in the dredging out of the berth at the new No. 8 jetty, by means of which there would be 32 ft. of water at low tide, which would permit of ships loading cargoes of 8,000 tons without grounding. This would be of great benefit to ship owners and shipping, and would have the result of attracting more shipping to the port.

Need for Housing

Referring to housing, he said there was little prospect of the Council undertaking a scheme themselves, as they could not build houses to-day to let at an economical rent below £25 to £30 without the rates. He considered the direction in which the Council should assist housing in the borough was to encourage working men, as he considered there was never a better opportunity than at the present time. Men could now get a loan from the Government through the Council for 90 per cent. of the cost of the houses built, towards which they could get a subsidy of a lump sum of £75, or £6 per year for twenty years. The Lord of the Manor was prepared to offer building sites for this purpose at a ground rent of only £1 per year. It would pay the Council to contribute up to a penny rate to foster the erection of houses by private builders because he considered from the increased rateable value these created they would get pounds. If by that means they could get 50 houses built in the borough it would add considerably to the prosperity of Fowey.

Trade with Russia

Councillor K. G. Spratt, a member of a Fowey firm of shipbrokers, in submitting "The Health of the Mayor," spoke of overseas shipments of China Clay, and said he was glad to see that shipments to Russia had started, and though small to start with they were expecting greater things next year. The prosperity of Fowey depended on shipping, and certainly there was a great future for it if they could help as a body to press for better things as regards dispatch, which was the main thing.

The Mayor, responding, remarked that much of the prosperity of Fowey depended upon the way the port was administered, and in this connection said it was a lucky thing for Fowey that the Board had got a new order in which the Council were able to elect four representatives. Through their having been given more power on the Harbour Board they had been able to buck things up a good deal. Referring to the Council's finance, he said since they got their charter in 1913 they had reduced their old loans of £4,847 by £3,670. Recently they had embarked upon a water scheme which had cost them £16,450, the works including the largest covered reservoir in Cornwall, which had a capacity of a million gallons. They had also embarked upon a £4,000 scheme for the supply of water to the jetties for shipping, their present revenue from which was £700 per annum. This would increase as shipping increased.

Commercial Intelligence

Mortgages and Charges

*[NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]*

SANDWICH BRICK AND TILE WORKS, LTD. Registered October 23, £100 debenture, to J. J. Williamson, Queen Street, Deal, solicitor ; a third charge on 50, King Street, Deal, and a second general charge.

STANDARD BRICK AND TERRA COTTA CO., LTD., Buckley (Ches.). Registered October 18, £5,000 debenture, to Branch Nominees, Ltd., 15, Bishopsgate, E.C. ; general charge. *Nil. October 10, 1923.

London Gazette

Companies Winding Up Voluntarily

BRACKEN (T. H.) AND CO., LTD. E. D. Taylor, 7, Bond Place, Leeds, chartered accountant, and W. Emmerson, 99, Albion Street, Leeds, chartered accountant, appointed joint liquidators. Meeting of creditors at the offices of Messrs. John Gordon and Co., 7, Bond Place, Leeds, on November 19, at 3 p.m.

DUXHURST POTTERY, LTD. E. C. Finlason, 6, Quality Court, W.C.2, appointed liquidator.

LAUNCESTON BRICK AND TILE CO., LTD. By extraordinary resolution, October 3, 1923.

seems to yield a very finely divided clay, which cannot fail to find many users in the near future.

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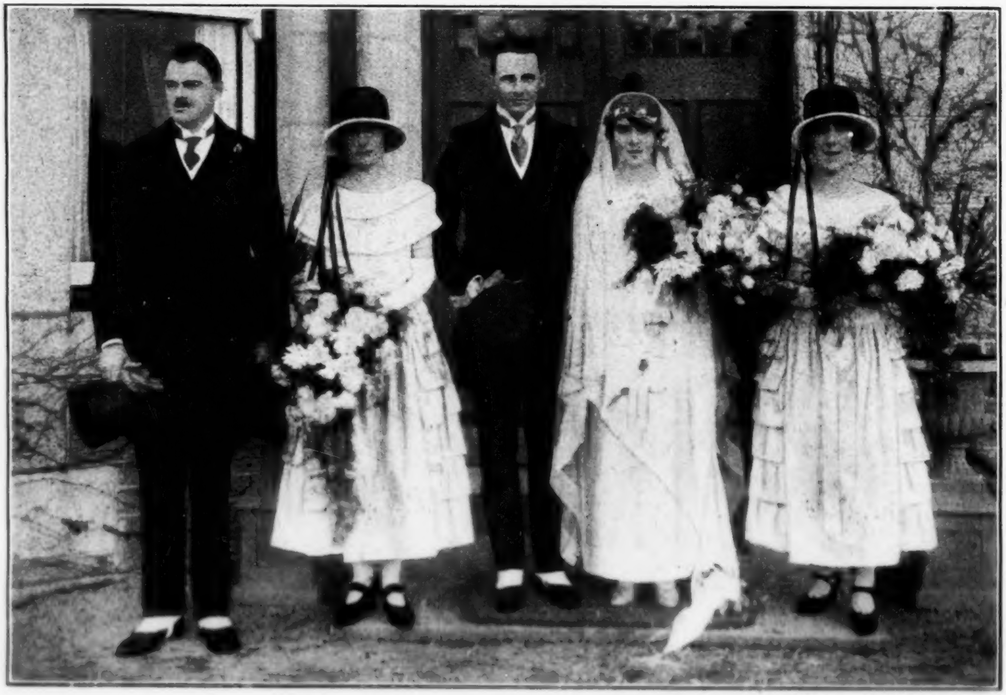

[Photo:—J. H. Coath & Sons.

MR. J. W. HIGMAN, JR., BRIDE AND PARTY.

Marriage of Mr. J. W. Higman, Jr., at St. Austell

THE marriage of Mr. John Wheeler Higman, Jr., son of Mr. John Wheeler Higman, J.P., of Polgray, St. Austell, and Miss Dorothy Michell, only daughter of Mrs. Michell, of Point Gribben, St. Austell, which was solemnised in the Parish Church, proved quite a big society event as well as an occasion of particular interest to the China Clay industry. The

of beauty and charm. Her bridesmaids were Miss Doris Bradbeer, friend of the bride, and Miss Hilda Higman, sister of the bridegroom, who were each gowned in pale blue and silver shot taffata trimmed with Broiderie Anglais. Their hats were of black satin ribbon with shoes and stockings to match, and carried bouquets of pink carnations and white chrysanthemums. The service was choral and the Vicar, the Rev. E. Roberts, officiated. Captain E. G. Baker, of Longtown, Cumberland, acted as best man, and Mr. G. B. Dobell, Town Clerk of St. Austell, a friend of the bridegroom, carried out the duties of usher. Nuptial music was rendered by the organist, Mr. W. Brennand Smith, F.R.C.O., and the hymn, "The Voice that breathed o'er Eden," was sung.

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Mr. MacDonnell says: "It would be venturesome to prophesy Continental trade prospects, and I do not know that in these days one could justifiably qualify a China Clay man's journey over the Continent as being a business trip.

Business is a very laudable motive, and even though a very serious proposition, it can be harnessed to convey an enterprising traveller to many pleasant Continental resorts. The difficulty is planning to get to places worthy of notice, and holding sufficient attraction, during the height of the season, for, unfortunately, seasons have an annoying habit of clashing. However, with careful preparation, it is possible to arrange a fairly pleasant programme.

On such an adventure, the romance of business, I am ever ready to start at a moment's notice. As any experienced and frequent traveller will tell you—I only speak of men—packing is not a lengthy ordeal. To stuff a few things into a suit-case, not forgetting a dinner-jacket, does not even require the services of a valet.

In order not to forget that I am travelling on business, I always carry with me, when going to the Continent, an attaché case containing samples of China Clay and records of Continental business deals, concluded when the mark was worth a shilling, and the lira about tenpence. I discovered about three years ago that it takes less than three hours to get to Paris from London by air. On that occasion I made my first air trip, and I believe I was the pioneer in carrying China Clay by aeroplane. Ever since, I have made that means of travel whenever possible. On the last occasion I travelled to Holland by air, carrying China Clay, my fellow-travellers were a lady, presumably a milliner, carrying a band-box, and a man hauling a "Jap" engine. Business in Holland you may expect me to talk about, but Dutch money is worth far too much and the Dutchman is rather reluctant to part with it. As I intended to do business in Holland, I felt I must complete a deal or risk losing my self-respect. From intended seller I therefore turned buyer and replenished my stock of cigars at so low a price that the deal almost justified my visit to the Netherlands. I then lost no time in continuing my journey to Paris, but an incident almost hindered my progress and might have landed me in jail. The Customs officials on the Franco-Belgian frontier discovered not only my cigars, but also my samples of China Clay. The latter puzzled them, and caused them to hold up the train. They informed me that I would be interviewed by a "higher authority," and while they went in search of him, they left [illegible] Customs officials and police

erst business friends and anon likewise, I hope, but meanwhile just good friends. We lunch and dine together and talk, even yet, and perhaps the French ever will, about Lloyd George and the Treaty of Versailles. But of business in France there is little to say. The French cannot buy our goods owing to the deflation of our currency, which is fostering the competition of French and Bohemian Clays. One works alone in France which used to consume three thousand tons of Cornish Clay per annum now uses that quantity of French Clay, and not a ton of English Clay. A fortnight in Paris, even in summer, is pleasant, but a business man cannot linger, and I was perforce compelled to continue on my journey to Biarritz, where many business men hide themselves during the month of August, and thence on to San Sebastian.

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Properties of American Clays

Co-operative work between the U.S. Department of the Interior and the Central of Georgia Railway to determine the value for ceramic use of various clay deposits of Georgia has been concluded at the Ceramic Experiment Station of the Bureau of Mines, Columbus, Ohio. The work was divided into five parts: clay washing; laboratory work on the crude and washed clays; manufacture and testing of refractory materials; manufacture of vitrified face bricks; and manufacture of white ware. Washing tests on some of the most promising clays were made in the special washer developed by the Bureau of Mines. These tests, supplemented by laboratory tests to determine the burning, shrinkage and other properties of the clays, showed that some of the clays were suitable for manufacture of white ware. Others proved to be excellent

The China Clay Trade Review

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Contents

American and English Clays

With so many important markets for China Clay, either restricted or altogether cut off, it has been a fortunate thing for the industry that America has been able to give us so large a share in her business as she has, but the figures we quote below seem to us very conclusive proof that for some reason or other we are not obtaining our full share of orders.

It will be seen that whilst in 1914 we exported to the United States 320,217 tons, since that date, excepting in 1920, when we exported 317,979 tons, there has been a decided drop in the tonnage delivered there, and this in spite of the paper and pottery industries reaching their record production in U.S.A.

The tonnage delivered to America since 1912 is as follows :—

Year.	*Tons.*
1912	252,382
1913	247,705
1914	320,217
1915	205,883
1916	235,187
1917	213,851
1918	152,383
1919	180,896
1920	317,979
1921	140,237
1922	289,230
and up to September, 1923	246,200

The domestic clays of the United States are being used in a way which perhaps some of the English producers hardly realise, and we are told by the United States Government report that the China Clay output of that country last year showed an increase of 69 per cent. on previous years. This requires very careful thought by the English China Clay producers, as the reports from America show that trade is still in a prosperous condition.

We quote below from an American bank report for November, which we consider gives a correct account of the state of trade in the United States to-day :—

"Measured by all the normal standards, the country is in a prosperous condition. Labour is well employed at high wages ; the physical volume of output is large ; freight car loadings are at their peak of the year ; commodity prices on the whole are stable and relatively high ; the banking and credit structure is thoroughly sound.

True business is not up to that of last spring when activity was at flood tide, and when production reached a higher point than was ever before attained in this country. But it is far from being poor, and to say that it is poor, as some people are saying, simply because it is not so good as it was at the height of the year's boom is altogether misleading. Output of manufactured goods is from 5 to 15 per cent. below the 1923 peak, but at the same time it is from 10 to 40 per cent. above the autumn of 1922, and then the country was considered to be experiencing real prosperity."

Whilst Germany was taking 94,000 and Russia 35,000 tons of China Clay in 1914, and these two markets are now taking very little from us, it is very necessary that we should make every effort to continue to supply the American market with our clays, and that every effort should be made by English China Clay producers to strengthen their position in 1924.

The report which we publish in another part of this paper by "Kaolin" on his recent visit to America, bears out what we have said with regard to the use of American domestic clays to a far greater extent than has been hitherto realised.

Colloidal China Clay

For some time past several China Clay firms have been producing Colloidal Clay. This clay does not seem to have made the headway which some of the trade had hoped, but it is probably because manufacturers have not yet found the many advantages to be derived from its use. Certain tyre firms are, we believe, using it in the manufacture of their tyres, and it has valuable medicinal properties.

In a recent article by Dr. Rudolph Lorentz, he gives this definition of colloidal matter :—

"The colloidal state of matter refers to a particular condition that certain kinds of matter assume in which the particles are neither in state of mechanical suspension nor in that of a pure solution. Sugar dissolves in water and sand is suspended in the same medium. The sugar solution can be passed through a filter paper of regular unsized paper, and nothing remains behind on the filter. On the other hand, the suspended sand is entirely separated from the water when the mixture of sand and water is filtered. The water passes through clean while the sand is retained on the filter paper.

"A colloidal solution, and we may take as a characteristic example a solution of glue or gelatine, will pass through the filter paper just as cleanly as a true solution of sugar in water. But while the latter will just as readily pass through the finer pores of animal membranes or parchment paper, the colloidal solution refuses to go through. The result is that the colloidal, in this case glue, will become separated from the medium, water. A solution that will act in this manner is known as a colloidal solution."

There can be no doubt that when the uses for this clay are better understood there will be a growing demand for it, and we believe that the efforts now being made by several of our China Clay producers in this direction will in the long run bring them the return they have hoped for.

There are various methods of producing Colloidal Clay now being used in the China Clay works, each one of which may have its own special advantages, and each process

seems to yield a very finely divided clay, which cannot fail to find many users in the near future.

Colloidal chemistry, though still in its infancy, has yielded valuable results in whatever field it has been applied, and should be of great interest to the pulp and paper maker.

The process of manufacturing Colloidal Clay is bound to make it a higher price than the ordinary clays, but if it can be produced at a reasonable price there is no reason why its production should not assist the trade materially to improve sales in the coming year.

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Both the bride and bridegroom received many valuable presentations, including a silver tea service from Messrs. H. D. Pochin and Co., and a silver spirit kettle from the staff. The bridegroom's present to the bride was a cheque and a blue Persian cat, to the bridesmaids aquamarine pearl-diamond brooches. The bride's gift to the bridegroom was a gold wristlet watch and a gold mounted walking stick.

Greater St. Austell

THE *Western Morning News* of December 11 says :—

"At last there seems a prospect of the apparently interminable question of the extension of urban St. Austell being brought to a close, the application heard at the County Council inquiry at St. Austell yesterday being on a virtually agreed basis. The application, however, includes a very much smaller area than was previously asked for, and omits some districts, such as Porthpean and part of Mount Charles and Charlestown. This is to be regretted, because although the latter are not at present drained, that is not to say that they should not be, and it would have been much better to have carried the larger scheme at once than to make two bites at a cherry. However, the addition of 1,143 acres instead of the originally contemplated 2,240 will very materially relieve the congestion from which St. Austell urban has suffered in the past, and will constitute a substantial urban community which may in time grow to something even more important.

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The "higher authority," in truth, a very peaceful man, informed me that it had been reported to him by his underlings that I had in my possession a large consignment of cocaine. An elementary examination of the incriminating goods convinced this man of science, however, that they were but China Clay, and I was permitted to continue my journey, the Customs officials having, in their excitement, forgotten about my cigars.

Of Paris I have very pleasant recollections. To know and understand a Frenchman one should meet him in Paris. He is at home there, exuberant in his friendship and hospitality; but when he comes to England he is "damped" by our atmosphere and loses part of his genial personality, mainly in his endeavour "to do in Rome" and to make himself agreeable to us. In Paris my friends are innumerable, erst business friends and anon likewise, I hope, but meanwhile just good friends. We lunch and dine together and talk, even yet, and perhaps the French ever will, about Lloyd George and the Treaty of Versailles. But of business in France there is little to say. The French cannot buy our goods owing to the deflation of our currency, which is fostering the competition of French and Bohemian Clays. One works alone in France which used to consume three thousand tons of Cornish Clay per annum now uses that quantity of French Clay, and not a ton of English Clay. A fortnight in Paris, even in summer, is pleasant, but a business man cannot linger, and I was perforce compelled to continue on my journey to Biarritz, where many business men hide themselves during the month of August, and thence on to San Sebastian.

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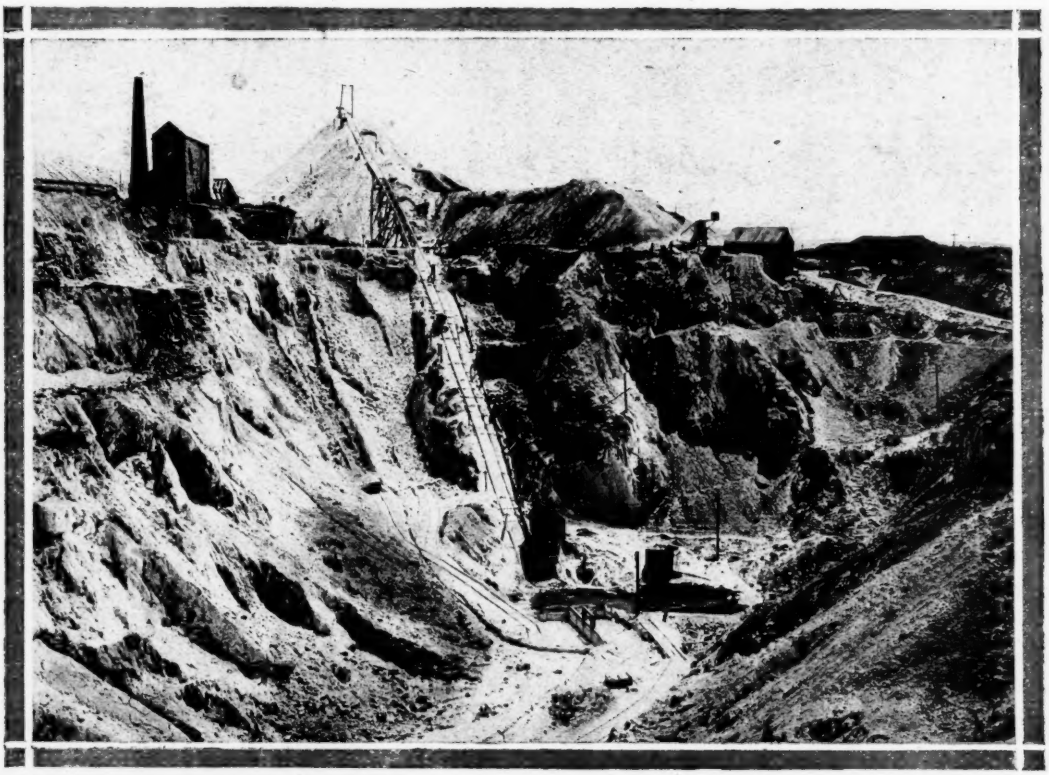
On my return journey I met some Englishmen in Paris. They were there to buy Continental goods, and ridiculed the idea of my being a seller—a seller of English goods on the Continent. But in my travels I also turned buyer. Buyer of what? If I were to answer perhaps English Customs officials might hear, and become too inquisitive when next they have the opportunity of asking me if I have anything to declare.

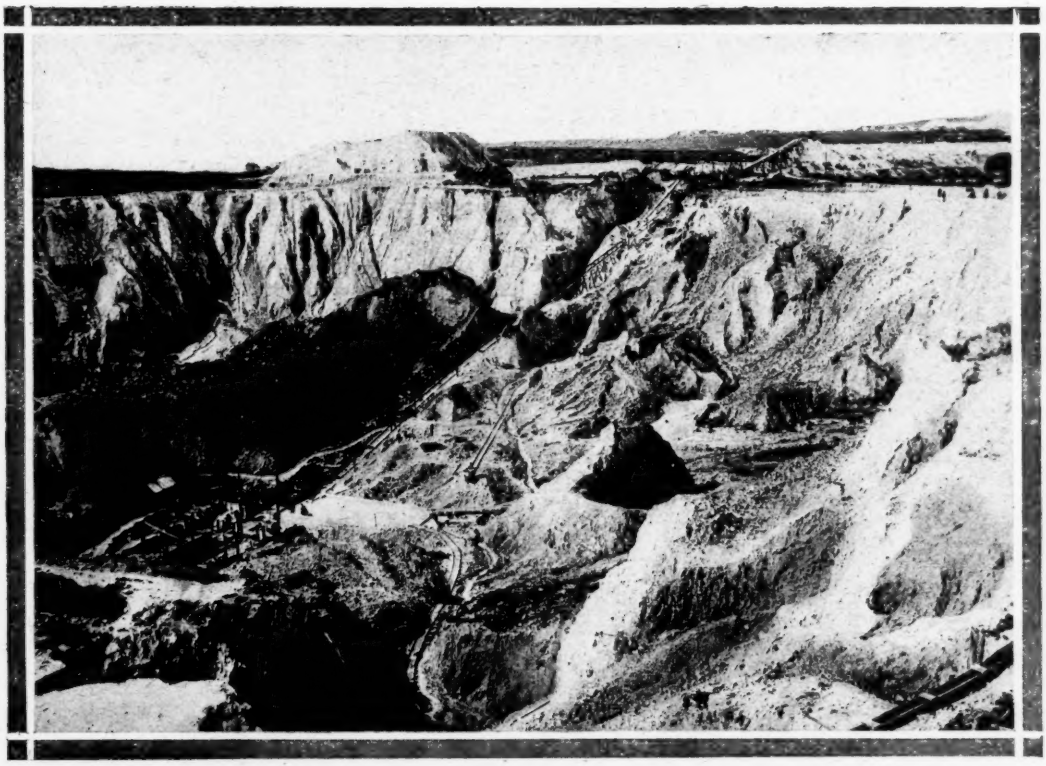
Properties of American Clays

Co-operative work between the U.S. Department of the Interior and the Central of Georgia Railway to determine the value for ceramic use of various clay deposits of Georgia has been concluded at the Ceramic Experiment Station of the Bureau of Mines, Columbus, Ohio. The work was divided into five parts: clay washing; laboratory work on the crude and washed clays; manufacture and testing of refractory materials; manufacture of vitrified face bricks; and manufacture of white ware. Washing tests on some of the most promising clays were made in the special washer developed by the Bureau of Mines. These tests, supplemented by laboratory tests to determine the burning, shrinkage and other properties of the clays, showed that some of the clays were suitable for manufacture of white ware. Others proved to be excellent filler material, and the Southern station of the Bureau of Mines is using these washed clays in plant practice tests in the filler trade. The clays selected in general are, if properly prepared, suitable for the manufacture of refractories. Therefore, 20 tons of a selected clay were made up into fire clay shapes at a large manufacturing plant in accordance with plant practice. These bricks have been tested in doors and roof of an electric furnace for melting steel, in oil fired furnaces; for steel-pouring ladles; in boiler settings; in ceramic kilns; and as bungs in furnaces for making malleable iron. They gave exceptional service in practically all tests.

Experiments are in progress to develop face brick from certain of these clays, and present results indicate that a satisfactory product will be obtained. The purpose of this work is to produce a vitreous, buff-face brick, which type of brick cannot be made from materials at present in use in the South. The bricks dry well and when properly made burn to a pleasing buff without checking. Semi-commercial scale tests at two plants show that several of the Georgia clays can be used in floor tile bodies. In wall-tile bodies a much smaller proportion of clay is desirable to prevent checking. Factory tests on white ware and electrical porcelain are in progress.



ENGLISH CHINA CLAYS, Ltd. **HENDRA CLAY WORKS, St. Dennis, Cornwall, producing the finest quality potting clay in the world.**



ENGLISH CHINA CLAYS, Ltd. **CARRANCARROW CLAY WORKS, near St. Austell, producing good bleaching and paper-making clays.**

A Recent Visit to U.S.A.

By Kaolin

I SUPPOSE most China Clay producers have at one time or another had occasion to visit the U.S.A. in pursuit of their business. America has been our best export market for many years past, and English China Clays have found a ready sale amongst the paper mills and potteries of that huge country. Not so many years ago a visit to the States was regarded as an affair to be considered seriously as regards the time taken. To-day with the fine floating hotels of the Cunard, White Star, and other lines sailing from Liverpool and Southampton, and traversing the distance of some 3,000 odd miles in under six days, a business man can accomplish his business, visiting many towns in the States, and be back again in London or Cornwall within three weeks, if necessary.

The particular Royal Mail Steamer on which I booked a passage was the Cunarder, *Berengaria*, which sailed from Southampton.

Punctually to the minute the great steamship got away for its first call at Cherbourg. To-day the *Berengaria* is one of the three largest ships afloat. She is 919 ft. long—almost a fifth of a mile. If stood on end she would be 149 feet higher than the Woolworth Building in New York.

The population of the *Berengaria* is over 4,000 souls. It is truly a city—a city of the sea. A crew of more than 1,000 and over three thousand passengers—these hundreds of people live together on the great ship for a week without crowding, without half of them ever meeting, their living apartments occupying nine deck levels, nine stories. There are literally acres of deck space over which these crowds are thinly scattered.

THE POTTERY WORKS OF J. L. MOTT, TRENTON, NEW JERSEY, U.S.A.

Every detail of the structure of the ship profits by this added size. In every detail of the passengers' comfort this sense of space adds greatly. The halls leading to the different parts of the ship are not mere passage-ways. They are broad corridors. The staterooms are not narrow cabins. They are commodious rooms. There are no berths in the saloon staterooms of the *Berengaria*. Every room is furnished with a modern metal bedstead; in double staterooms there are broad twin beds.

The superlative mechanical features of the *Berengaria* are best appreciated from the fact that the workings of the ship never obtrude upon the consciousness of the voyager. The ship goes: the manner or means of its going are never apparent. That states the perfection of its structure and organisation. There is almost no vibration from the great powerful turbines. The size of the vessel, and the equipment of Frahm compensating tanks, make it ride smoothly over the roughest seas. The *Berengaria* is an oil-burner, and so its upper decks are never made unpleasant by the clouds of smoke that may hang, in lowering weather, about a vessel burning coal.

In its appointments and decorations the *Berengaria* realises the same idea of splendid comfort. Everything on the *Berengaria* is what it purports to be. The woodwork throughout the ship is a marvel of beauty and craftsmanship. Rich carpets and hangings, the damask and chintzes that brighten the staterooms, the Gobelin tapestries in the lounge—all these things are fitting. They are worthy of the part they play in adding to the atmosphere of ease and of elegance that pervades the ship.

The character of the *Berengaria* attracts a following of the most distinguished travellers between Europe and America. The passengers comprise a brilliant society of leisured folk who enjoy to the utmost the luxury of their surroundings. And no effort has been spared to provide means for their divertissement. There is dancing in the ball-room or out of doors every evening. All day the decks are gay with groups of people at various sports. The gymnasium and swimming pool offer indoor recreation. There is a good library, replenished for every voyage. A daily newspaper, summarising the news received by wireless, is distributed every morning. There are concerts and card games, amusements for every moment of the sparkling days. And if one wants solitude the boat is big enough to provide that too.

It is in the dining saloon that a ship is finally judged. But in cuisine and service the *Berengaria* fulfils the expectations aroused throughout the rest of the ship. The *caltes des jours* offer a range of choice seldom demanded on shipboard. The markets of Europe and America supply luxuries in and out of season for the menus of the *Berengaria*. And the service has more of the intimacy, the personal thoughtfulness of a club than a hotel.

The arrangement of the staterooms of this ship provides an unusual number of charming single rooms for persons travelling alone. And, on the other hand, there are many staterooms *en suite*, which afford pleasant privacy to families or friends making the voyage together. The imperial suites of the *Berengaria* are perhaps the most luxurious apartments on any ocean steamer—they are certainly excelled by none.

If I have devoted rather much space to a description of one of these ships, it is because it applies to so many of these "ocean greyhounds" of to-day. Those of us who travelled to the States or Canada twenty or twenty-five years ago will realise the enormous difference in the comfort and speed of travelling, then and now.

Amongst other distinguished guests on board we had Dr. Nansen, the well-known explorer, and the usual tribe of Pressmen and photographers boarded the ship in New York Bay.

One-and-a-half miles from the "Battery" we passed the colossal figure of "The Statue of Liberty." It lights the harbour with an electric torch held 306 feet above the water. This statue was presented to America by the French nation. How can I describe the skyline as one steams slowly into New York? Enormous skyscrapers try to outvie each other in size. I suppose there is nothing like it in the world. When one remembers that only 300 years ago the wooden island, which now holds the largest and tallest buildings in the world, was occupied by a few Indian tents, and that New York has to-day a population of close on 8,000,000, one begins to realise its rapid growth and need for the skyscraper.

Everything is on the gigantic scale in America. I stopped at the Pennsylvania Hotel, located on Seventh Avenue, as no doubt have many China Clay business men done before me. This is the largest hotel in the world and has 2,200 rooms and 2,200 baths.

Quite apart from my business in New York, I wanted to see the City again after many years. What a change in Fifth Avenue. This once exclusive and expensive avenue, the residence of millionaires, has now become the main business and shopping street. Even Woolworth with his 5 or 10 cent. store, greatly daring, has built a fine shop in this once exclusive avenue, and I am informed, in spite of enormous rental, has been entirely successful. Woolworth's Building, the highest building in the world, is well worth a visit. It consists of 54 stories, and a small charge is made to take you up, in a non-stop elevator, to the top. From the tower one obtains a bird's-eye view of Manhattan, East River and Brooklyn.

There are, of course, a very large number of skyscrapers in New York, such as the Adams Building in Broadway. The Singer Building at the corner of Broadway and Liberty Street, which stands 612 feet high, has 47 stories, and carries 5,000 tenants to their offices in this one building alone each day. This business requires 16 Otis elevators working all day long.

Truly a wonder city.

Now, of the people in this wonder city, my impression of them (for what it is worth) is that they are a keen, hard-working

and kindly lot. The Almighty Dollar looms largely in their talk and thoughts—and why shouldn't it? It does with our business men in this country—though we may not be quite so frank about it.

Apart from business they are "good fellows." Nothing they can do for you is too much trouble, and I am sure that every China Clay producer from Cornwall or Devon has many good friends in America.

With regard to business matters and those trades that are of special interest to the China Clay industry—I had the opportunity of visiting many places, though my time was short.

Many of the paper mills were not running full capacity at the time of my visit (November, 1923). I give below a photograph of one of the largest paper mills in U.S.A. The Oxford Paper Co., which contains 12 machines for super calender, machine finish book and paper for coatings, and has a capacity of 600,000 lbs. every 24 hours.

The president and general manager of the Oxford Paper Co., is Mr. H. J. Chisholme. Here, too, I met Mr. Mills who, some will remember, was on a visit to Cornwall in the early part of this year with his wife, neither of whom have forgotten the pleasant time they spent there, and their interest in seeing over some of the China Clay pits.

If some of the paper mills were not at that time working at full pressure, I found the pottery business of J. L. Mott and Co., Trenton, New Jersey, full of activity. I was very interested in being allowed to go over this large concern, by the courtesy of the general manager.

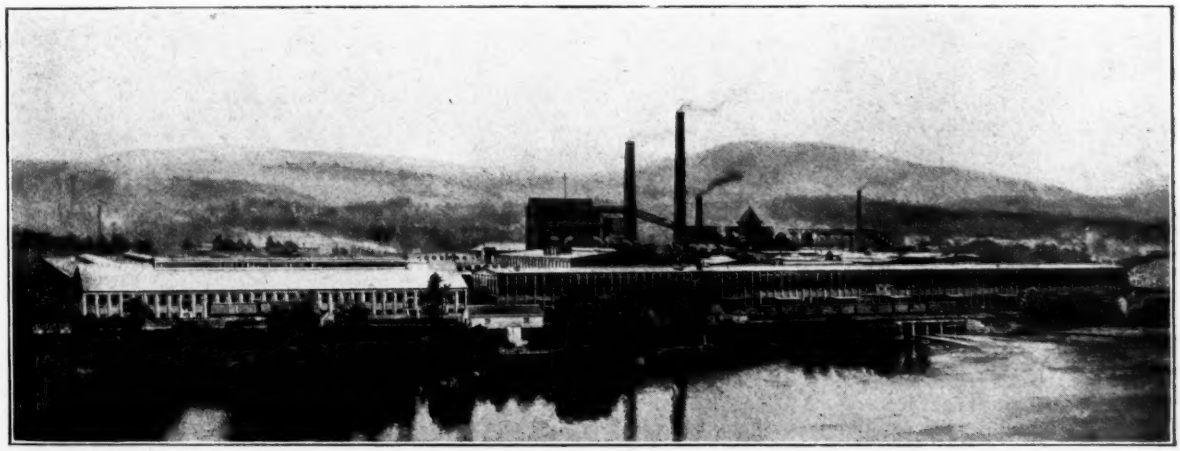
A short visit to Philadelphia, the Quaker City of Pennsylvania, concluded a very pleasant and all too short a time in U.S.A.

Was it a coincidence that on my return journey on the *Aquitania* that one issue of the *Daily Mail*, published each day aboard ship, should have a column headed "Cornwall's Trade in China Clay," and a sub-heading, "U.S.A. Demands Keep Exports at High Level?"

So that even at sea China Clay was being discussed.

Interview with Mr. H. S. Pochin

It was particularly fortunate that our St. Austell representative was enabled to have a brief and uninterrupted chat with Mr. H. Stanley Pochin, J.P., the managing director of the firm of Messrs. H. D. Pochin and Co., of Manchester, at the White Hart Hotel, St. Austell, on the occasion of his recent visit to the Clayopolis, where the firm have now such extensive operations. Mr. Pochin was accompanied by his co-director, Mr. David T. Taylor, who had apparently been attacked by a Cornish cold which, we hope, will be completely disposed of long ere our publishing day. It was a chilly night and there were quite a number of China Clay merchants at the hotel who were down for the meeting of the trade. There was quite an outward manifestation of optimism upon all at the improved prospects of the trade. Mr. Pochin said that October had made a substantial recovery and November had provided some good shipping, whilst several large boats were at Fowey awaiting their cargoes. Mr. Pochin said that the industry was under a debt of gratitude to the Great Western Railway Company for the provision of such an extraordinary transporter to the new jetty at Fowey. Unfortunately, through lack of siding accommodation, boats have not been able to load as fast as was anticipated; in fact, some of the firm's own boats had to be withdrawn from the new jetty and placed in position on the old electrical jetty because of this failure, and at the meeting of the producers in the earlier part of the day a telegram was forwarded to the managing director, Mr. Felix J. C. Pole, calling his attention to the matter. We have no doubt but this defect will be soon remedied, remarked Mr. Pochin, and when those facilities which the railway company have installed at Fowey get into smooth working, large boats will be able to load without so much delay as has been their handicap in the past. When boats can be filled quicker it should serve to reduce freights; therefore, a general speed up in despatch is much desired. In response to an enquiry of the developments at Caudledown Mine, Mr. Pochin informs us that the mass of over-burden and granite was so great that they put on four shifts of men to deal with it. It was a difficult problem, but the product at this particular mine was one of the very best brands in the market, and was well worth the great effort. The extension of the Wheal Remfry Mine is proceeding very satisfactorily, and the new dry which is being erected there will



The Mill of The Oxford Paper Co. at Rumford, Maine, U.S.A.

The manufacturing plant at Trenton covers 26 acres and comprises potteries, iron and brass foundries, enamelling shops, cabinet shops, ornamental works, etc.

Here I was handed over to the care of Mr. James B. Campbell (a good Scottish name) who kindly took me into the clay room.

In a large number of rooms was stacked all sorts of clay.

China Clay from England (I am not going to tell you which firm supplied it), clay from Tennessee, Virginia, and North Carolina, and, of course, much ball clay.

I saw here some excellent examples of the different kinds of China Clay supplied by the U.S.A. producers, and there can be no doubt that for certain purposes their clays answer the purpose of the American potter admirably.

The following was given me as a typical potter's formula, but not by the above firm:—

34 per cent. Flint.
20 per cent. English China Clay.
10 per cent. North Carolina Clay.
9 per cent. Florida.
15 per cent. Ball Clay.
12 per cent. Felspar.

100 per cent.

be completed early in the new year. The dry will contain all the latest improvements in its construction for economy in fuel and manual labour. It will also increase the drying capacity of Wheal Remfry from an annual production of 44,000 tons to nearly 58,000 tons. The Wheal Remfry Mine is notable amongst papermakers for the production of the N.B.S. Clay, and also the renowned Remfry Potting Clay, for which there is a very good demand.

Mr. Pochin spent a very strenuous day at the Mainbow Ball Clay Mines in Devonshire, which necessitated a motor car journey of over 100 miles, and when it is considered that his visit to Cornwall was so brief, arriving at St. Austell by the 5.50 a.m. train on the Monday and returning to Manchester by the 10.23 p.m. on Tuesday, it certainly reveals the life of our big industrial builders as well as their physical invulnerability.

Mr. Pochin was pleased to inform us that the Ball Clay industry was exceptionally good and was in demand by the pottery markets in all parts of the world. They had that day commenced the loading of a large cargo for the Continent —"The Mainbow Clay Co., which is a subsidiary to the firm of Messrs. H. D. Pochin and Co., has not had an easy task in the development of this mine," said Mr. Pochin, "but we have certainly overcome the unexpected difficulties now and are producing both the Black Potters' Clay and a good sample of the Devon Blue Clay." The works are under the management of Mr. St. Maur and the annual production is being rapidly extended.

The Cornish Hosiery Co., which is another branch of the firm's big operations, although administered as a separate undertaking, is now working most successfully. A large store at Roten, near St. Dennis, has been converted into a suitable factory, and installed with machinery which can be described as a modern equipment. It has already been extended by the erection of a washhouse, which is used for making the fabric unshrinkable. At present they are employing 30, principally daughters of the China Clay workers in the district, and this employment is greatly appreciated, and hopes are expressed that the business will so increase as to provide a great boon to this important China Clay area. In reply to an enquiry whether the Chemical manufactories of the firm were in full running order, Mr. Pochin informs us that through the unprofitable charges which were ruling and foreign competition their manufactories were not working to their full output, but they were hoping to emerge from such conditions with the general industrial improvement in the country.

General Election and China Clay

THE effect that tariffs might have on the China Clay industry was a subject that engaged the attention of both candidates in the Penryn–Falmouth Division, of which the St. Austell China Clay district forms a part. Sir Courtenay Mansel was again the Liberal candidate, and Capt. Denis Shipwright the Conservative. Sir Courtenay hails from Wales, while Capt. Denis Shipwright is the husband of the only daughter of the late Sir Edward Hain, shipowner, of St. Ives, Cornwall, where Capt. Shipwright is developing a China Clay bed recently discovered.

The contention on the Liberal Party's side was that tariffs would only send up the cost of the various materials used in the production of China Clay, without helping the industry in the direction of developing new markets. The Conservative contention was that tariffs would be a weapon in getting other foreign countries to lower their tariffs against China Clay, and would enable the home markets for China Clay, such as the potteries and the paper mills, to compete more successfully with the foreign imports if tariffs were imposed on imports of paper and pottery.

At the last election there were four candidates, one of whom was Mr. Joe Harris, the Workers' Union organiser, who this year stood as a Labour candidate in Devonport, and was again defeated. The result in the Penryn and Falmouth Division was remarkable, the figures being: Sir Courtenay Mansel (L.), 17,015; Capt. D. Shipwright (C.), 10,428; Liberal majority, 6,587.

The other Cornish candidate directly interested in the China Clay industry was Capt. A. H. Moreing, who is interested in Tehidy Minerals, Ltd., which controls several China Clay properties. At the last election Capt. Moreing stood as a National Liberal in the Camborne Division and won the seat in a three-cornered fight with an independent Liberal and Labour. At the recent election he stood as a National Liberal with Unionist support, and was opposed by Mr. Leif Jones, his Liberal opponent at the previous election. The result of the election was the return of Mr. Leif Jones with 11,794 votes against 8,096 for Capt. Moreing, the successful candidate's majority being 3,698.

In the North Cornwall Division, in which the English China Clays North Cornwall China Clay works at Stannon Moor are situated, it was the first contest since 1910. Sir George Croydon Marks was the Liberal and received 12,434 votes against 9,581 cast for Mr. C. A. Petrie (C.), winning by a majority of 2,853.

In the St. Ives Division, where Messrs. John Lovering and Co. and Messrs. H. D. Pochin and Co. have China Clay works, and in which division is the port of Penzance, the successful candidate was Sir Clifford Cory, the coal magnate, who defeated Mr. J. A. Hawke, K.C. (C.) and Mr. A. E. Dunn (Lab.) in a three-cornered fight.

In the South-East Cornwall Division, in which the China Clay port of Fowey and the Park China Clay works of Messrs. H. D. Pochin and Co. are situated, the Conservative, Major-General Sir Frederick Poole, son-in-law of the late Sir Charles Hanson, who formerly held the seat, was again defeated by Mr. Isaac Foot, the Liberal.

For the first time since 1906 every division in Cornwall is now represented by a Liberal.

Canadian Clays for Industry

THE province of Saskatchewan is the possessor of extensive deposits of clays which may be looked upon as important raw materials. There are clays suitable for the manufacture of good building brick, structural and agricultural tile and sewer pipe, ball clays and stoneware clays for the manufacture of pottery, and also refractory clays for fire-brick.

During the past twelve years, the clays of Saskatchewan have been under investigation by the Dominion Department of Mines. Attention was first directed to the high-grade clays of the province by Mr. Joseph Keele in the report on his investigation of the clays and shales of the western provinces. A more detailed study of the clays of southern Saskatchewan was made later. Under the auspices of the Provincial Government, the University of Saskatchewan has recently established a ceramic department, with Professor W. G. Worcester in charge, for the purpose of carrying on extensive tests on the clays of the province and to provide a course in ceramic engineering which is designed to fit men to supervise modern clay industries.

Interest has lately been aroused in regard to fire-bricks. Prof. Worcester has supplied bricks for tests in a locomotive of the Canadian Pacific railway. These will be submitted to a rigid endurance test, and examined at the end of each run. He states that, if they stand the test, they may displace millions of dollars' worth of imported bricks, but he reserves definite prophecies until the final results are known.

China Clay Works Support Hospital

A FINE effort has been made by the China Clay works' employees to bring up their donations to the St. Austell Cottage Hospital and have reached last year's total of £170. Already this year more patients have been admitted to the Hospital than there were last year. Here is a list of the works which have subscribed: West Car claze, £1 13s. 6d.; Bodelva, 7s.; Bloomdale, £10 18s. 7d.; Restowrack Downs, £1 9s. 8d.; Wheal Martyn, £5 13s. 11d.; Pontsmall, £6 2s.; Hendra Quarries, £2 18s.; Burngullow, E.C.C., £2 6s.; Pitmen, £1; Hallew, £4 13s. 4d.; Quarries, £7 9s. 7d.; Kernick, £6 0s. 3d.; K. K., £2 1s.; Ruddle Common, £2 4s. 6d.; G. Halviggan, £6 7s. 6d.; Lower Lansalson, £4 13s. 10d.; Trethurgy, £1 12s.; Little Johns, £7 16s. 6d.; Dubbers, £4 17s. 3d.; Drinnick, £13 6s. 3d.; Hendra, £11; Goonheath, £13 1s. 10d.; Cleaves, £3 8s.; North Carloggas, £1 19s.; Goonamarth, £2 12s. 6d.; West Goonvarrow, £1 1s.; Trethowal, £2 12s. 7d.; North Goonbarrow, £8 10s.; Goonbarrow, £3 10s.; Virginia, £1 13s. 6d.; Mid-Cornwall, £3; Gothers, £4 15s.; Wheal Rashleigh, £3 5s.; Higher Ninestones, £2 0s. 9d.; Dorothy, £2 13s.; Little Treviscoe, £2 3s.; Ruddle, £3 10s.; Carvear, £1 18s.; Caudledown, £5 5s.; total, £171 9s. 7d.

China Clay Notes and News

China Clay Revival Maintained

The returns of China Clay to the end of November were not available in time to make a detailed analysis of the position for the eleven months, but the figures to the end of October suffice to show that the revival in the industry that set in last year has been well maintained, despite the additional obstacle of the Ruhr occupation, which did not operate last year.

October Weather Bad for Shipping

With a total tonnage of nearly 66,000 during October, the recovery in the trade, which received a rather severe set-back in August, was more than maintained. The increase over September was 3,600 tons, and an increase over the month before of 5,000. The last previous highest month was June, when 71,350 tons were delivered. The exports, which are included in these figures, amounted to nearly 42,000 tons, about the same quantity as was exported in September. The difference in the export figures and the total deliveries is over 23,000 tons, which went to home destinations.

Taking into consideration that October was one of the worst months for shipping, owing to the gales, the total reached is very satisfactory. No doubt, loading by means of the new elevator at No. 8 Jetty at Fowey materially assisted in this, which is borne out by the returns, which show that nearly 56,000 tons were shipped from Fowey. Though trade has fluctuated from month to month this year, the total volume has kept well ahead of that for the corresponding period of last year, the actual figures being 683,120 tons for the ten months this year, compared with 546,410 tons last year.

Overseas Trade

The rough conditions prevailing at sea hampered shipments of clay to the Continent and to home ports, many cargoes on order having to be delayed. Cargoes taken by big steamers from Fowey were also seriously interfered with, so that the maintenance of the volume of export trade at the figure mentioned was a very satisfactory achievement. The United States of America took nearly 20,000 tons during the month, but the totals to Continental countries were rather low, Belgium being the biggest customer with 4,082 tons. The export of 4,676 tons to Canada is an indication of the growing demand for China Clay in the steadily growing number of paper mills in that colony. Through the change-over in the political *regime* in Spain, exports of China Clay to that country dropped to practically nil, while Germany's quota amounted to only 540 tons. France was represented by 1,585 tons, and the Netherlands 1,686 tons. Sweden, Finland, and Norway were responsible for over 5,000 tons, while Italy figured in the list with 1,954 tons. Another feature of the export figures was the low total exported to India, being less than 200 tons.

Cause of European Lost Trade

The effects of the General Election will not be injurious to the China Clay industry, but may have the contrary effect, for any unusual increase in the consumption of paper increases the demand for China Clay. As to what have been the causes mainly responsible for unemployment in the China Clay industry, certainly imports have not constituted one of them, because there are no imports of China Clay. The failure of the industry to regain its pre-war volume has been directly traceable to the closing and restriction of Continental markets as a result of the war. Two countries alone—Germany and Russia—have been responsible for the loss of something like 140,000 tons per annum, while the lessened demand from the Allied countries has been responsible for another 60,000, representing to the industry a loss of roughly £400,000 per annum.

West Bridge Line

Now the Government appear to be assisting in the development of railway schemes for the relief of unemployment one would have thought that some movement would have been made for the relaying of the railway from West Bridge, St. Austell, to Pentewan. Before the war this line used to convey many thousands of tons of China Clay, principally for small coasting vessels which carried consignments of 150 to 200 tons to the home markets and on the Continent, and in this direction the port of Pentewan served a very useful purpose to the China Clay industry in the immediate neighbourhood of the town of St. Austell. During the war the line with all its rolling stock was taken away for war purposes and the port almost became derelict. Those who have any interest in the port ought to see what can be done in the matter, and assist in its development ere rival ports secure the monopoly of the China Clay trade. The town of St. Austell was undoubtedly a great loser when the port fell into disuse.

An Advertising Journal

We have received a copy of J. Murray Allison's *20th Century Advertising*.

This publication is one of the finest we have seen dealing explicitly with advertising, and now that the value of advertising and propaganda work is becoming more and more apparent in the China Clay industry, such a publication as this should be of real value to those whose business it is to look after the propaganda side of the industry.

There are still a few China Clay producers who pretend that they do not see the value of advertising, but some of the largest producers are taking the lead in this matter, not only in trade publications and brochures, but we have recently seen a very fine film produced showing the production side of the industry.

Such advertising is undoubtedly of the greatest value to the trade and should not be left to only a few of the larger firms.

There is also now being sold a small cinema apparatus which representatives could carry round with them, and which could be utilised to show the consumer the producing side of China Clay.

This at once makes a good talking point for the representative and is of interest to the consumers, many of whom have a very hazy idea of how China Clay is produced.

In Mr. Murray Allison's paper every class of advertising is discussed, and we congratulate him on producing such a fine publication.

China Clay Prices

At the meeting of the China Clay producers on November 25th, to consider the prices of China Clay for next year, it was decided that they remain as at present ruling. The last two drops in the prices were made without making any reduction in the wages of the clay workers, and the margin of profit at present prices is such as not to admit of a further drop, having regard to production costs.

Kerrow Clay Works

We regret that in our interview with Mr. A. D. S. Stocker in our last issue we inadvertently described the Kerrow Clay Works of the firm of Messrs. Gross and Stocker as a small mica works, whereas it is a work that is being rapidly developed as one of the important concerns of the firm. Kerrow works are noted for its very fine plastic clay and is in great demand among the leading paper makers, both in this country and in the United States of America. We are glad to give this correction and our apologies to the firm for any misapprehension that might have been made in the minds of our readers.

Old China Clay Captain's Death

The death occurred on Monday, November 12th, at Myrtle Villa, Trethosa, St. Stephens, of Capt. Daniel Harris. The deceased was connected for many years with the West of England China Clay Co., and also the English China Clay Co., being Captain of Hendra Downs Clay Works, and later of Kernick, from which he retired on account of ill-health. Capt. Harris was 68 years of age.

Mr. C. Brian

Mr. C. Brian, Vice-President of The Paper Makers' Importing Co. of America, who has just been on a flying visit to England, and has spent some days in Devon and Cornwall, informs us that business in the China Clay trade and Ball Clay industry is proceeding very satisfactory. Although America will be in the throes of a presidential election, there is every prospect of a good year of American consumption of Cornish China Clay and Devon Ball Clays.

Some Paints, etc., for which China Clay is Used

CHINESE WHITE (WATER COLOUR).

(1) Dissolve 4 oz. of pulverised gum arabic in 16 fluid oz. of cold water.

(2) Dissolve 1 oz. boracic acid or pulverised borax in 4 fluid oz. of glycerine.

(3) China Clay 3 lbs., zinc oxide 1 lb.

Mix (1) and (2) and then stir in (3).

The two pigments should be thoroughly mixed before adding the binder.

SHOW CARD WHITE.

(1) Dissolve 1 oz. of sodium carbonate in 32 fluid oz. of hot water, and then add 2 oz. pulverised bleached shellac. Allow it to simmer for an hour or so, stirring frequently. Strain and let cool and then add 4 fluid oz. of denatured alcohol or wood spirit.

(2) 2 lbs. China Clay
2 lbs. Gilders' bolted whiting
2 lbs. Zinc oxide.

Mix (1) and (2). Add water for use.

FIREPROOF WHITE FOR STOVES, ETC.

(1)	Silicate of soda solution (36° Baume)	16 fl. oz.
	Water	6 ,,
	White sugar or light coloured syrup.....	2 ,,
(2)	China Clay	8 oz.
	Pulverised soapstone	2 ,,
	Zinc oxide.....	2 ,,

Mix (1) and (2). This paint burns to a light grey but finally turns white. Without the sugar it burns white immediately. The sugar prevents the soluble glass setting too rapidly.

PLASTIC MODELLING CLAY.

China Clay, 16 oz., mixed with benzine, 5 fl. oz., and then kneaded with white vaseline, 4 oz.

When the benzine has evaporated the clay remains in a soft plastic mass which may be worked into any shape. The degree of plasticity depends upon the quantity of benzine.

The clay simply mixed with glycerine gives a plastic mass suitable for modelling.

Rye flour	1 part
China Clay	3 parts

mixed with a little water give a composition which hardens when dry.

China Clay	1 part
Rye flour	3 parts

mixed with water give an absorbent plaster used in medicine.

WATER "MATT" GOLD SIZE FOR PICTURE FRAMES AND MOULDINGS.

(1)	Soak 1¼ oz. gelatine, for one hour in 10 fl. oz. of cold water; dissolve on a water bath	
	Glycerine	1 fl. oz.
	Oil of Clove	20 drops
(2)	China Clay	16 oz.
	Red Armenian bole.....	8 ,,
	Fr. yellow ochre.....	2 ,,
	Orange mineral	1 ,,

Mix a sufficient quantity of (1) with (2) to make a firm paste.

China Clay for Manufacture of Ultramarine Blue

THE clays required must be very white and unctuous to touch, as then they are usually very fine and readily enter into the composition of the blue. Abstraction made of humidity and water of constitution, the only constituents of interest in China Clay are silica, alumina and the percentage of iron which is prejudicial.

The density of the clay varies from 2·21 to 2·26. We shall give a few analyses of the clay, the varieties of which are not very great, at least from the point of view of the question with which we are dealing. Amongst those we give there are none which will produce resisting blues, for which reason it is always necessary to add silica under some form or other, with the advantages and inconveniences associated with this addition.

	I		II	
	(1)	(2)	(1)	(2)
Humidity at 110° C.	3·75	—	6·56	—
Water of Constitution	13·33	—	16·58	—
Silica	42·73	52·10	40·84	53·75
Alumina.....	38·54	47	35·26	45·10
Iron oxide.....	0·75	0·75	0·60	0·60
	99·10	99·85	99·84	99·45
Proportion of $Si^2OAl^2O^3$ ...	1·10	—	1·19	—

CLAY FOR ULTRAMARINE GREEN.

Humidity at 110° C.	3·80	—
Water of Constitution	13·66	—
Silica	43·64	53·3
Alumina.....	37·82	46·2
Iron oxide.....	0·46	0·46
	99·58	99·96
Proportion of $SiO^2Al^2O^3$	1·14	—

The first two clays are both English and are soft when burnt. When dried they can only be used for weak blues. The clay for green is also English, but, differently to the other two it hardens in burning and becomes suitable for making green.

BOHEMIAN CHINA CLAY.

	(1)	(2)
Humidity	13·12	—
Water of Constitution	23·53	—
Silica	36·34	57·65
Alumina.....	25·55	40·60
Iron oxide.....	0·94	0·94
	99·48	99·19
Proportion of $SiO^2Al^2O^3$	1·44	—

CHINA CLAY WHICH GIVES FINE BLUES.

	(1)	(2)
Humidity	0·5	—
Water of Constitution	8·8	—
Silica	61·84	68·2
Alumina.....	27·72	30·8
Iron oxide.....	0·79	0·79
	99·65	99·79
Proportion of $SiO^2Al^2O^3$	2·21	—

As can be noted, Bohemian China Clay is a little richer in iron than the others, but on the other hand the percentage of silica is very great. An excellent clay would be of the preceding type, in which the percentage of $SiO^2Al^2O^3$ is 2·21.

When the clay reaches the works it is not fit for manufacture of ultramarine. It may be more or less humid, although bought from a dry sample, as during a journey by rail or sea it may absorb water accidentally. Then the clay must be dried and, to make some blues, burnt—that is to say, until all the water of constitution has evaporated. The China Clays used during the war contained 20 to 30 per cent. humidity with an average, in water of constitution, of 15 per cent., so that to obtain 75 lb. of dry clay it was necessary to employ 100 lb. of humid, and in the case of a calcined clay the yield was only 64 lb. These figures demonstrate that about 130 lb. of humid clay would give 100 of dry, and 157 lb. of the former 100 of burnt clay. In such circumstances cost of labour, drying and calcination considerably increase the price of the clay, sometimes making it twice as much, because to remove the water of constitution completely the clay must be well burnt. It is not rare to meet with China Clays which, after burning, contain 1 to 2 per cent. water. Once burnt the clay must be kept in a dry place.—*Boletin de la Sociedad de Fomento Fabril of Valparaiso, Chile.*

China Clay Agency

INQUIRIES have been received by the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, to whom further inquiries should be addressed with the reference number quoted. A firm of agents in Reading, Pa., U.S.A., wish to communicate with British producers and exporters of whiting and China Clay, with a view to obtaining agencies, on a commission basis, for the State of Pennsylvania, New Jersey and New York. (Reference No. 596.)

Shipping and Export News of the Month

We give below the latest particulars relating to arrivals and sailings of ships engaged in the China Clay Trade, at the principal British clay ports. Registered exports of China Clay with countries of destination, and other shipping and export matters are dealt with.

Shipping—Fowey, November, 1923

Arrived.		Name.	Sailed.	Destination.
Nov. 1,	S.S.	*Moss Rose*	Nov. 7,	Runcorn
Nov. 1,	S.S.	*Bilton*	Nov. 4,	Brussels
Nov. 1,		*Zampa*	Nov. 14,	Odense
Nov. 1,	S.S.	*Coniscrag*	Nov. 6,	Barrow
Nov. 1,	M.V.	*Jules Claes*	Nov. 14,	Bristol
Nov. 1,		*Ruth*	Nov. 14,	Norrkoping
Nov. 1,	S.S.	*St. Francois d'Assise*	Nov. 7,	Rouen
Nov. 2,	S.S.	*Marnix*	Nov. 8,	Rouen
Nov. 2,	S.S.	*Blush Rose*	Nov. 5,	Preston
Nov. 2,	S.S.	*Nunnington*	Nov. 9,	Rouen
Nov. 4,	S.S.	*Desia*	Nov. 9,	Antwerp
Nov. 5,		*Thor*	Nov. 14,	Fredrikshald
Nov. 6,	S.S.	*Kentish Coast*	Nov. 10,	Liverpool
Nov. 6,	S.S.	*Scartho*	Nov. 10,	Kotka
Nov. 6,		*Woitja*	Nov. 20,	Gefle
Nov. 6,	S.S.	*Westdale*	Nov. 9,	Runcorn
Nov. 7,	S.S.	*Heatherlea*	Nov. 10,	Antwerp
Nov. 7,	S.S.	*Primrose*	Nov. 10,	Runcorn
Nov. 7,	S.S.	*Irmi*	Nov. 10,	San Francisco
Nov. 9,	M.V.	*Nautic*	Nov. 15,	Leith
Nov. 9,	S.S.	*Leaside*	Nov. 14,	Terneuzen
Nov. 9,	S.S.	*Cervantes*	Nov. 13,	Genoa
Nov. 9,	S.S.	*Bro*	Nov. 17,	Antwerp
Nov. 9,	S.S.	*Condor*	Nov. 19,	Antwerp
Nov. 11,	S.S.	*Noordstroom*	Nov. 14,	Norrkoping
Nov. 11,	S.S.	*Busk*	Nov. 14,	Gravesend
Nov. 12,		*Flying Foam*	Dec. 3,	Rochester
Nov. 12,	S.S.	*Italy Maru*	Nov. 23,	Boston, U.S.A.
Nov. 12,		*Cathrine*	Nov. 24,	Gothenburg
Nov. 12,	S.S.	*Falmouth Castle*	Nov. 15,	Weston Point
Nov. 13,		*John Sims*	Nov. 21,	Par
Nov. 14,	S.S.	*Sunnyhill*	Nov. 17,	Antwerp
Nov. 14,	S.S.	*Robrix*	Nov. 16,	Grimsby
Nov. 14,	M.V.	*Leeuwerik*	Nov. 19,	Rotterdam
Nov. 14,	S.S.	*Jolly Kate*	Nov. 17,	Ridham
Nov. 14,	S.S.	*Mistley*	Nov. 17,	Ridham
Nov. 16,	S.S.	*Gouwestroom*	Nov. 23,	Amsterdam
Nov. 10,	S.S.	*Calcaria*	Nov. 19,	Bristol
Nov. 19,	S.S.	*Branstone*	Nov. 20,	Nantes
Nov. 19,	M.V.	*Schwan*	Nov. 24,	Grangemouth
Nov. 19,	S.S.	*St. Francois d'Assise*	Nov. 22,	Nantes
Nov. 19,	M.S.	*Patent*	Nov. 23,	Antwerp
Nov. 20,	S.S.	*Yvonne*	Nov. 24,	Brussels
Nov. 20,		*Rose*	Nov. 20,	Par
Nov. 20,		*Beatrice Maud*	Nov. 29,	London
Nov. 20,	S.S.	*Irena*	Nov. 24,	Lancaster
Nov. 20,		*Prima*	Dec. 1,	Raumo
Nov. 20,	S.S.	*Moss Rose*	Nov. 24,	Weston Point
Nov. 20,		*Flora*	Dec. 6,	Drammen
Nov. 21,		*Sigrid*	Dec. 6,	Bo'ness
Nov. 21,	M.V.	*Young Fox*	Nov. 30,	St. Malo
Nov. 21,	S.S.	*Mayrix*	Nov. 24,	Brussels
Nov. 21,	S.S.	*Marnix*	Nov. 27,	Antwerp
Nov. 21,	S.S.	*Royal Firth*	Nov. 24,	London
Nov. 22,	S.S.	*Hayle*	Nov. 26,	Fleetwood
Nov. 22,	S.S.	*Wild Rose*	Nov. 26,	Preston
Nov. 22,	S.S.	*Ohio Maru*	Dec. 6,	Boston, U.S.A.
Nov. 22,	S.S.	*Industria*	Nov. 27,	Rouen
Nov. 23,	S.S.	*Hogstad*	Nov. 28,	Rouen
Nov. 23,	S.S.	*Ualan*	Nov. 28,	Ridham
Nov. 23,	M.V.	*Alfa*	Dec. 1,	Bo'ness
Nov. 24,	S.S.	*Mersey*	Nov. 29,	Grimsby
Nov. 24,	S.S.	*Guelder Rose*	Nov. 28,	Weston Point
Nov. 25,	S.S.	*Busk*	Nov. 30,	Gravesend
Nov. 25,	S.S.	*Wearsider*	Nov. 29,	Granton
Nov. 25,	M.V.	*Aarsten*	Nov. 29,	Leith
Nov. 25,	M.V.	*Earl Cairns*		*
Nov. 26,	S.S.	*Guardian*	Nov. 30,	London
Nov. 27,		*Edith*		*
Nov. 27,		*Rise*		*
Nov. 27,	S.S.	*Star of the Orient*	Dec. 1,	Rochester
Nov. 28,	S.S.	*Trader*	Dec. 1,	Newcastle
Nov. 28,	S.S.	*Florentino*	Dec. 3,	Genoa
Nov. 29,	S.S.	*Manfred*	Dec. 3,	Viborg
Nov. 29,	M.V.	*Annen*	Dec. 5,	Karlskona
Nov. 29,		*Regulus*		*
Nov. 30,	S.S.	*Dorrien Rose*	Dec. 6,	Weston Point
Nov. 30,		*Hilda*		*
Nov. 30,		*Margrietha*	Dec. 6,	Antwerp
Nov. 30,	S.S.	*Pansy*	Dec. 4,	Preston
Nov. 30,	S.S.	*Falmouth Castle*	Dec. 6,	Runcorn

Par Harbour Shipping—November, 1923

Arrivals

Date.		Vessel.	From.
Nov. 1,	S.S.	*Tanny*	Barry
Nov. 1,	S.S.	*Goliath*	Fowey
Nov. 2,	S.V.	*Shortest Day*	Plymouth
Nov. 3,	S.V.	*Alice Williams*	Weymouth
Nov. 6,	S.V.	*Marna*	Charlestown
Nov. 7,	S.S.	*Magrix*	Teignmouth
Nov. 7,	S.V.	*Flora*	Transung
Nov. 7,	M.V.	*Regina*	Plymouth
Nov. 9,	S.S.	*Katherina*	Flamouth
Nov. 11,	S.V.	*Pursuit*	London
Nov. 11,	S.S.	*Robrix*	Hull
Nov. 12,	S.V.	*Snowflake*	Runcorn
Nov. 20,	S.S.	*Velocity*	Bristol
Nov. 20,	S.V.	*Rose*	Salcombe
Nov. 21,	S.S.	*Torpoint*	Plymouth
Nov. 21,	S.S.	*St. Leven*	Newlyn
Nov. 21,	S.V.	*Lilla*	Newlyn
Nov. 21,	S.V.	*John Sims*	Runcorn
Nov. 21,	S.V.	*Jane Slade*	Weymouth
Nov. 21,	M.V.	*Regina*	Plymouth
Nov. 21,	S.V.	*Garston*	Exeter
Nov. 24,	S.V.	*Henrietta*	Mevagissey
Nov. 27,	S.S.	*Robrix*	Hull
Nov. 28,	S.S.	*Wave Queen*	Barry
Nov. 30,	M.V.	*Katie*	Portsmouth

Sailings

Date.		Vessel.	Destination.
Nov. 1,	S.V.	*Rosina*	Queenborough
Nov. 1,	S.V.	*Hosianna*	Poole
Nov. 3,	S.S.	*Goliath*	Fowey
Nov. 4,	S.S.	*Tanny*	Penarth
Nov. 7,	M.V.	*Katie*	Rochester
Nov. 8,	S.V.	*Shortest Day*	Plymouth
Nov. 9,	S.S.	*Magrix*	Gravesend
Nov. 9,	S.S.	*Katherina*	Plymouth
Nov. 10,	S.V.	*Alice Williams*	London
Nov. 12,	S.V.	*Regina*	Plymouth
Nov. 14,	S.S.	*Robrix*	Fowey
Nov. 14,	S.V.	*Katherina*	Graveselines
Nov. 21,	S.V.	*Snowflake*	Weston Point
Nov. 21,	S.S.	*Velocity*	Penzance
Nov. 22,	S.S.	*St. Leven*	Cardiff
Nov. 22,	S.S.	*Torpoint*	Preston
Nov. 22,	S.V.	*Regina*	Pentewan
Nov. 24,	S.V.	*John Sims*	Plymouth
Nov. 26,	S.V.	*Rose*	Goole
Nov. 27,	S.S.	*Robrix*	Teignmouth
Nov. 28,	S.V.	*Lilla*	Runcorn
Nov. 29,	S.V.	*Marna*	Leith
Nov. 30,	S.V.	*Garston*	London

Charlestown Shipping—November, 1923

Arrivals

Date.	Vessel.	From
Nov. 5	*Antje*	Stromfors
Nov. 7	*Prima*	Frangsand
Nov. 7	*Adelphe*	Cardiff
Nov. 9	*Louistic*	Cardiff
Nov. 11	*Treleigh*	Portreath
Nov. 14	*Lady Daphne*	Truro
Nov. 17	*Emily Darbrick*	Truro
Nov. 17	*Helena Anna*	Falmouth
Nov. 20	*Earl Cairns*	Mevagissey

Sailings

Date.	Vessel.	Destination.
Nov. 12	*Treleigh*	Manchester
Nov. 18	*Antje*	Rochester
Nov. 21	*Adelphe*	Nantes
Nov. 21	*Louistic*	Nantes
Nov. 21	*Lady Daphne*	Rochester
Nov. 22	*Earl Cairns*	London
Nov. 23	*Emily Darbrick*	Runcorn
Nov. 24	*Helena Anna*	London
Dec. 3	*Lord Haig*	Rochester

November China Clay Deliveries

THE increase in the total deliveries of China Clay and China Stone shown in October, despite the roughness of the weather for shipping, was well maintained in November, when the previous month's totals were exceeded by over 2,000 tons, the total being 67,908 tons. The shipments from Fowey accounted for only 300 tons of this increase, Charlestown being responsible for 500 of it, and Par for 800, and the lots sent by rail for over 500.

The figures for November were the best since June when 71,347 tons were delivered. Taking the total for the 11 months of the year, 1923 has well maintained its lead over last year, the figures being 751,029 tons against 677,202 tons for the corresponding 11 months last year.

Details for November are as follows :—

Port.	Tonnage.
Fowey	55,155
Par	2,158
Charlestown	2,078
Plymouth	912
Newham	240
Total by sea	60,543
Total by rail	7,365
Grand total	67,908

Against 65,786 tons for October, and not 64,469 tons as published in last month's issue.

China Clay Exports

A RETURN showing the export of China Clay, the manufacture of the United Kingdom, from the United Kingdom to each country of destination registered during the month ended November, 1923.

COUNTRY OF DESTINATION.	QUANTITY. Tons.	VALUE. £
Finland	2,614	6,407
Esthonia	632	1,550
Sweden	1,553	2,582
Norway	1,782	2,756
Denmark (including Faroe Island)	358	1,010
Germany	536	1,160
Netherlands	2,607	5,963
Belgium	6,618	12,824
France	3,038	7,013
Switzerland	31	102
Spain	934	2,429
Italy	2,447	7,150
Egypt	50	190
Persia	—	2
United States of America	23,827	54,595
Mexico	20	80
Colombia	1	7
British Possessions.		
Irish Free State	5	13
Seychelles	50	200
Other Ports	826	3,300
Bengal, Assam, Bihar and Orissa	25	100
Victoria	5	20
New South Wales	22	128
New Zealand	5	28
Canada	75	213
Total Foreign Countries and British Possessions	48,061	109,822

Par Harbour Tide Table, December, 1923

(Greenwich Mean Time throughout.)

Day of Week.	Day of Month.	Morning.	Afternoon.	Height.
Saturday	1	10. 6	10.38	10.2
SUNDAY	2	11.13	11.51	10. 1
Monday	3	—	0.29	10. 5
Tuesday	4	1. 5	1.40	11. 3
Wednesday	5	2.13	2.44	12. 3
Thursday	6	3.13	3.41	13. 0
Friday	7	4. 8	4.34	13. 8
Saturday	8	4.59	5.25	13.11
SUNDAY	9	5.51	5.16	14. 0
Monday	10	6.40	7. 3	13. 9
Tuesday	11	7.25	7.47	13. 3
Wednesday	12	8. 9	8.31	12. 6
Thursday	13	8.54	9.17	11. 8
Friday	14	9.41	10. 7	10.10
Saturday	15	10.34	11. 3	10. 3
SUNDAY	16	11.34	—	9.11
Monday	17	0. 8	0.43	9.11
Tuesday	18	1.17	1.50	10. 3
Wednesday	19	2.21	2.50	10. 9
Thursday	20	3.17	3.41	11. 3
Friday	21	4. 3	4.24	11. 8
Saturday	22	4.44	5. 4	12. 0
SUNDAY	23	5.23	5.42	12. 1
Monday	24	6. 0	6.17	12. 3
Tuesday	25	6.34	6.51	12. 3
Wednesday	26	7. 8	7.25	12. 3
Thursday	27	7.53	8. 2	12. 0
Friday	28	8.21	8.41	11. 9
Saturday	29	9. 2	9.25	11. 4
SUNDAY	30	9.50	10.16	10.11
Monday	31	10.44	11.14	10. 8

H. L. VICKARY, Harbour Master.

Commercial Intelligence

County Court Judgment

[NOTE.—The publication of extracts from the " Registry of County Court Judgments " does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.]

GREEN BROS., Albion Pottery, New Whittington, earthenware manufacturers. £18 14s. 6d. October 26.

Mortgages and Charges

*[NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]*

AYLESFORD POTTERY CO., LTD. Registered November 13, £2,740, £260 and £1,100 mortgages, to E. Taylor, North House, Barming, and others. A. Hyland, c.o., etc., 9, King Street, Maidstone, and A.O.F., Maidstone and District; charged on various properties at Aylesford, Forstal, Boxley, etc. *£8,350. July 13, 1922.

CORNISH MELEDOR CHINA CLAY CO., LTD., London, E.C. Registered November 22, £10,000 debenture, to D. G. Collins, 118, Newgate Street, E.C., merchant, and others; general charge (subject to mortgage dated May 24, 1922). *£5,000. March 5, 1923.

NYEWOOD BRICK AND TILE WORKS, LTD., London, S.E. Registered November 14, Trust Deed dated October 26, 1923, securing £2,000 debenture stock and premium of 20 per cent.; general charge. *£4,000. July 25, 1923.

STANDARDISED CHINA CLAY CO., LTD., London, E.C. Registered November 12, £1,800 debentures part of £30,000; general charge. *£28,175. December 31, 1922.

WINDEBANK AND CO., LTD., Birmingham, paper manufacturers. Registered November 12, £20,000 debenture; to Branch Nominees, Ltd., 15, Bishopsgate, E.C., general charge. *Nil. December 31, 1922.

Satisfactions

AYLESFORD POTTERY CO., LTD. Satisfactions registered November 9, £1,200, balance of amount registered November 12, 1921; and £4,600, balance of amount registered November 14, 1921.

GIBSON AND SONS, LTD., Burslem, china manufacturers. Satisfaction registered November 6, £200, part of amount registered April 19, 1905.

IRISH PAPER MILLS CO., LTD., London, E.C. Satisfaction registered November 2, £4,200, part of amount registered June 9, 1921.